Consulting Engineer

April 1961

Photo by Fabian Bachrach

ROBERT W. BECK, managing partner and chief engineer of R. W. Beck and Associates, Seattle, Washington, has achieved national recognition as an engineering advisor to utility management. Beck personally serves on the five-man board of consulting engineers of the 775,000 kw, $275 million Rocky Reach hydroelectric project on the Columbia River. He also was employed by the Joint Congressional Committee on Atomic Energy to study the economic feasibility of adding electric power generation to a new production reactor now being installed by the AEC.

Continued on page 10

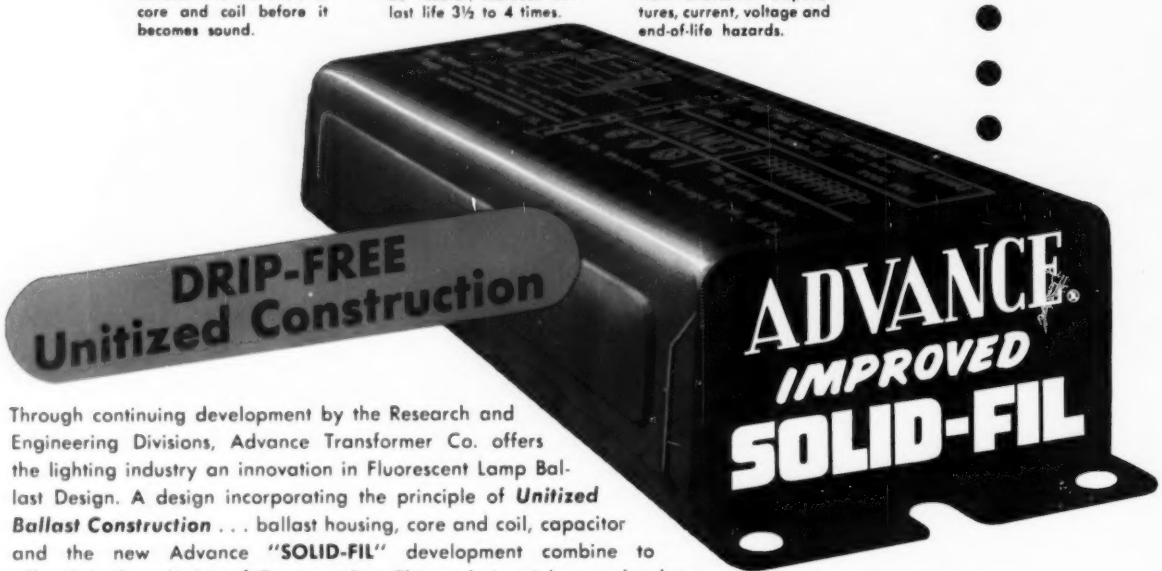
ADVANCE®

First with these major contributions to the lighting industry . . . . and NOW

Utilizing a special thermo-pliable compound that absorbs the vibration of core and coil before it becomes sound.

Up to 15% more light output, operate 15° to 20° cooler, increase ballast life 3½ to 4 times.

Thermally protected to safeguard against failure from excessive temperatures, current, voltage and end-of-life hazards.



Through continuing development by the Research and Engineering Divisions, Advance Transformer Co. offers the lighting industry an innovation in Fluorescent Lamp Ballast Design. A design incorporating the principle of ***Unitized Ballast Construction*** . . . ballast housing, core and coil, capacitor and the new Advance **"SOLID-FIL"** development combine to offer ***Drip-Free Unitized Construction***. This exclusive Advance development differs from other types of solid fill materials in that it retains a pliable consistency, and will not become brittle with age or heat, permitting retention of its excellent thermal and sound deadening characteristics. Accelerated heat tests, far above what will be experienced in an actual lighting installation, **proved conclusively no deterioration or drippage** of the Advance **"SOLID-FIL"** development.

Advance Improved **"SOLID-FIL"** Fluorescent Lamp Ballasts dissipate heat faster, provide greater safety, and offer the lighting industry the opportunity to utilize a quieter operating solid fill ballast. Ask your Advance representative or write for further details.

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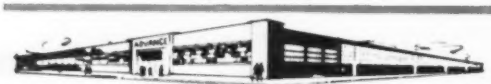
- **QUIETER**
- **MORE EFFICIENT HEAT DISSIPATION**
- **GREATER SAFETY**

Approved By CBM (Certified Ballast Manufacturers)

"The Heart of the Lighting Industry"



Mfg. in Canada by: Advance Transformer Co., Ltd. 5780 Pare St., Montreal, Quebec

ADVANCE®

TRANSFORMER CO.

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

New general offices of Swanson Brothers in Omaha, Nebraska. Air-conditioned efficiently and economically by gas-operated Carrier absorption refrigeration. Architects & Engineers: Leo A. Daly Co. Mechanical Contractor: J. J. Hanighen Co. Both of Omaha, Nebraska.

Swanson insured low operating costs with GAS and CARRIER absorption refrigeration

Swanson Brothers—nationally known in the foods industry – chose gas-operated Carrier absorption refrigeration to air-condition their beautiful new general office building in Omaha, Nebraska.

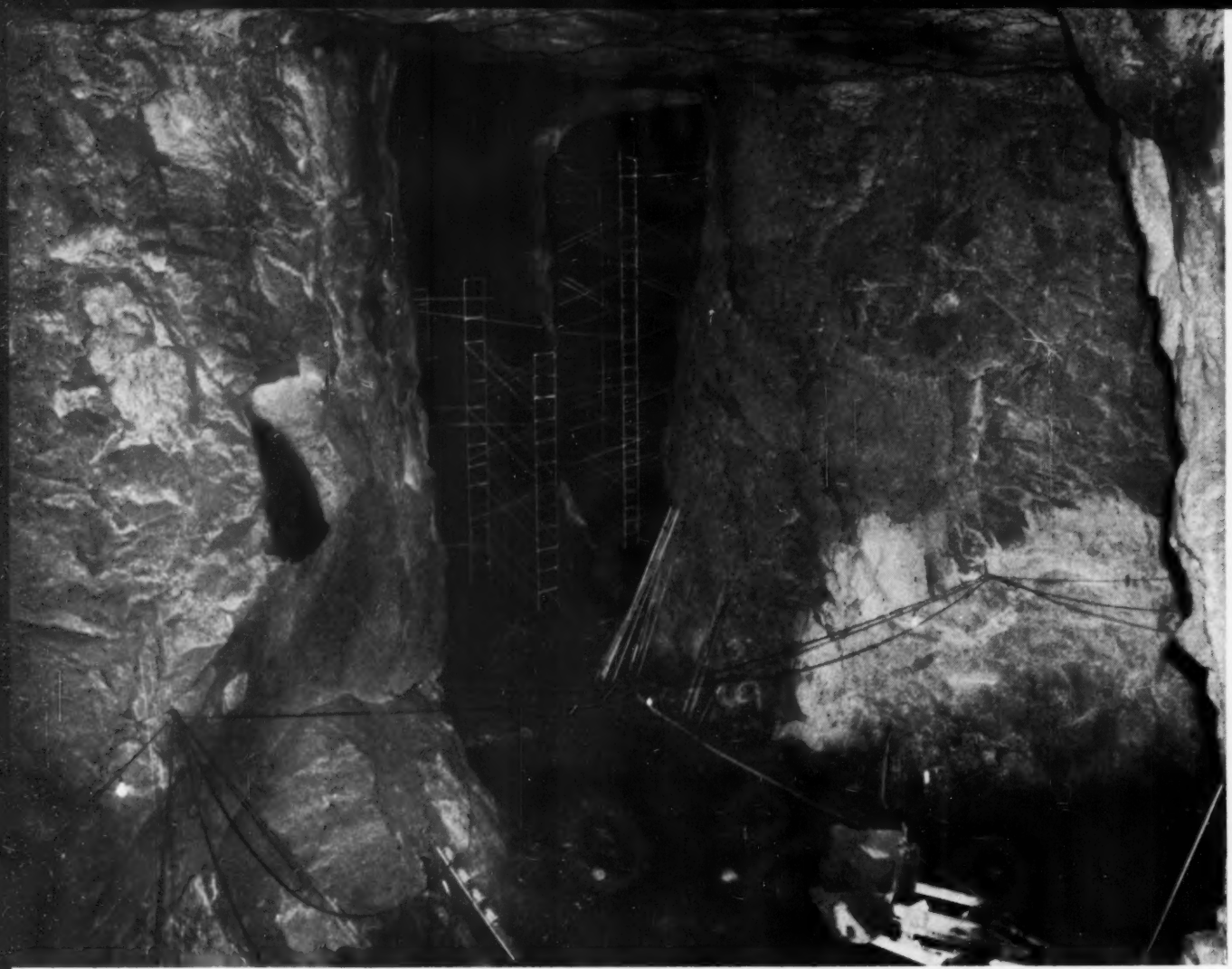
The basis for their choice was *lower costs*, with the unbeatable fuel economy of gas and the simplicity and trouble-free operation of the Carrier absorption unit. With no major moving parts, it quietly and efficiently uses steam from a gas-fired boiler to provide chilled water for cooling.

Carrier has solved the problem of sustained efficiency at partial loads in absorption cooling. An exclusive Carrier solution-capacity-control gives partial load efficiency unsurpassed by any other type of cooling system.

Trouble-free is the word for this 140-ton capacity gas-operated Carrier absorption unit at Swanson building. Says Wendell Mitchell, Building Engineer, "I really think this system is great. All I have to do is check it now and then. Never a bit of trouble."

You can keep air conditioning costs low and efficiency high, with gas-operated Carrier absorption refrigeration. For details call your local Gas Company, or write Carrier Air Conditioning Company, Syracuse 1, N. Y. *American Gas Association*

FOR HEATING & COOLING GAS IS GOOD BUSINESS!



250,000 BBL. FUEL TANK SEALED BY HALLIBURTON GROUTING

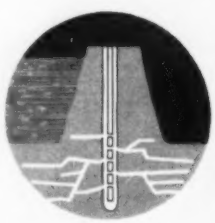
Uncontrolled water flow was entering this 250,000 bbl. LPG underground storage cavern through fissures — some as wide as ¼" — in the ceiling and sides of the cavern during its excavation.

To stop this troublesome water problem, the mining engineer called on Halliburton Pressure Grouting Service. Since prior grouting jobs using conventional materials and methods had failed to stop the water flow, Halliburton recommended treatments with HYDRO-LOK (PWG). This is a low-viscosity chemical grout with a controlled fluid time, allowing it to reach the water bearing zones. It then sets very quickly to form a stiff gel effectively sealing off the flow of water.

Some 600 separate injections of HYDRO-LOK (PWG) were made, varying from 3 gallons to 800 gallons each. A total of 7,946 gallons of HYDRO-LOK (PWG) and 736 gallons of Halliburton Hydromite was pumped into the fissures existing throughout the cavern. After 33 working days, more than 95% of the water flow had been stopped.

If you have an underground water problem, call on Halliburton to help you solve it. Contact the Halliburton Division Office nearest you, or write direct to:

Halliburton is financially able to perform any size grouting operation as a prime or sub-contractor.



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APRIL 1961 • VOLUME XVI • NUMBER IV

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BPA

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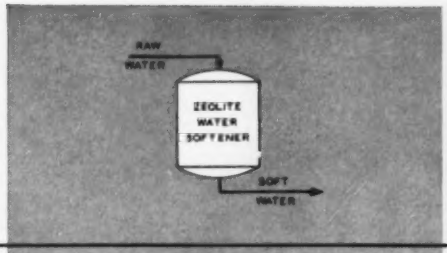
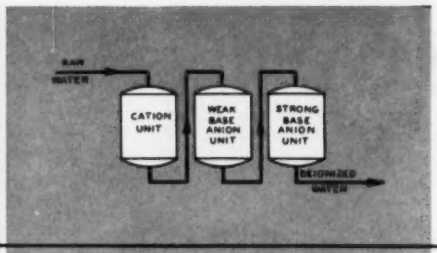
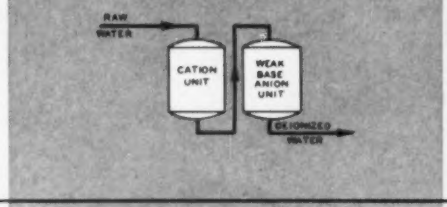
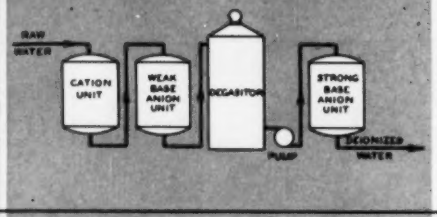




Delivers high quality CO_2 and silica free deionized water. Used to treat water of relatively low alkalinity.

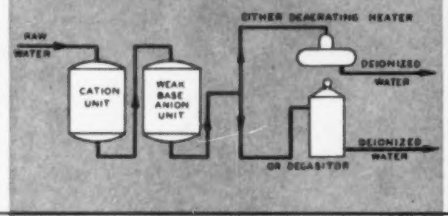
Delivers deionized water low in dissolved solids—suitable for many boiler and process applications.

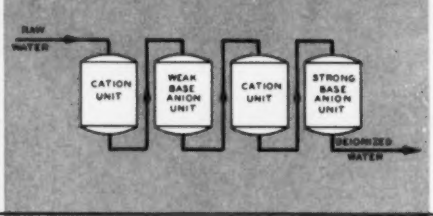




Delivers deionized water, free of CO_2 and silica. Very effectively used for waters of high alkalinity.

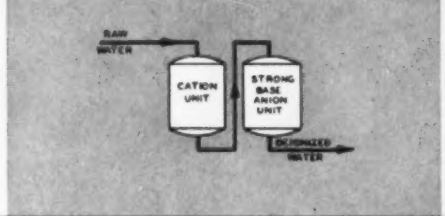
Delivers deionized water and eliminates CO_2 with either deaerating heater or degasitor.

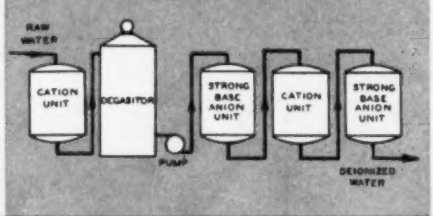




Delivers exceptionally high quality deionized water, free from silica and CO_2. Effectively used on waters of low alkalinity.

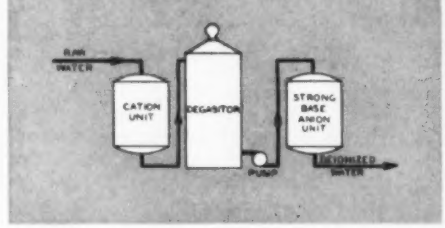
Delivers deionized water free from silica and CO_2. Used largely for waters of low alkalinity.

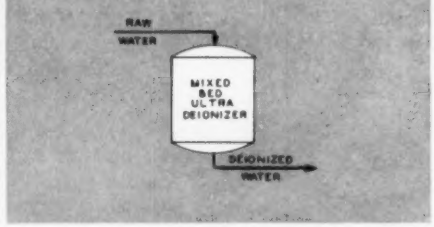




Delivers highest quality deionized water, free from silica and CO_2. Last two columns provide the "polishing" steps.

Delivers deionized water free from silica and CO_2. Usually built in large sizes for low cost CO_2 removal.





Delivers deionized water of highest known quality—free from silica and CO_2. Used alone and as "polishing" unit.

Yes, there is an Elgin ion exchanger that will exactly meet your needs . . .

Some of the modern methods we are using today are diagrammed above . . . and there are many combinations of these dictated by the variables in water supply and final use.

But whether your requirements can be met by a simple zeolite water softener—or whether you need the most highly "polished" water—this much is certain: The best and most economical solution to your problem must come from a firm like Elgin that offers *every* modern and authoritative approach.

Write for the Guide to Better Water Treatment — Bulletin 615

ELGIN SOFTENER CORPORATION

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Markland Locks and Dam on the Ohio River.

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Safe navigation through the busy Markland Locks on the Ohio River depends on the skill of experienced river pilots and bright uniform illumination. That's why Thompson Servisafe poles were specified by the engineers who designed the installation. As the lights are lowered, they are automatically disconnected. Maintenance personnel can replace burned-out bulbs and service fixtures on the ground . . . quickly and with complete safety.

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Request full details on specs, installation and costs.

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How *Imaginative Engineering* Put Taming Chicago's

John Dolio (right) in front of Powers Graph-O-Matic Control Panel with E. S. Anderson, engineer for the Illinois Psychiatric Institute.

The unusual temperature requirements specified for the new Illinois Psychiatric Institute presented an extraordinary challenge for John Dolio & Associates. This Chicago engineering firm was asked to provide an absolutely uniform temperature throughout the 11-story, T-shaped building. Because temperature variations cause extreme discomfort —even pain—to mental patients, the system had to be accurate, foolproof and automatic. Because Chicago temperatures rise or fall to extremes within hours—sometimes minutes —the system had to be capable of sensing the changing weather picture outside and automatically and simultaneously reacting inside.

The resulting design provides all the answers . . . in a Powers pneumatic control system that operates automatically 24 hours a day—every day—at a bare minimum of cost; a system that compensates instantly for sudden outdoor temperature changes; a system that can be checked and controlled by one man.

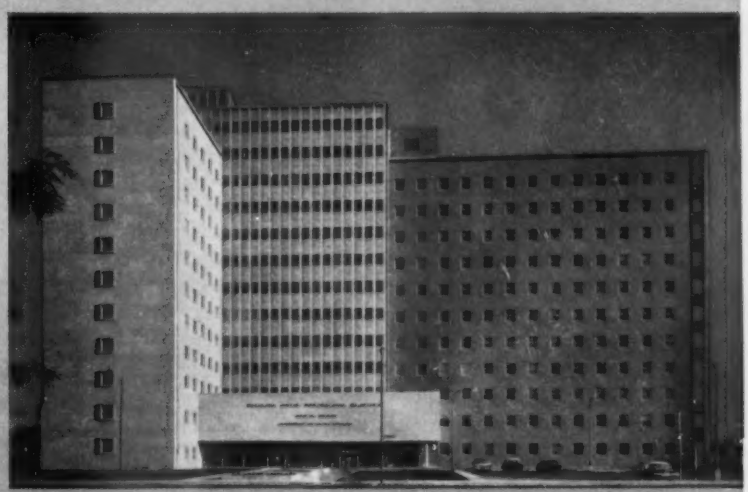
The result is a functional system of control where practical engineering principles were combined by the Dolio firm with a strong helping of ingenuity in order to whip some of the more unusual problems. For example, since chilled water was to circulate through ceiling heating-cooling panels, a safeguard against condensation was necessary. The engineers solved this problem with a series of dew point controls mounted at various locations in the ceilings. Thus, "controls on a control" prevent water temperature from falling to the point at which condensation could occur.

Phil Derrig, Chief Mechanical Engineer of the Dolio firm, inspects one of the dew point controls specially designed to prevent condensation of cold water in the ceiling heating-cooling panels.

Powers Temperature Control To Work Weather At Illinois Psychiatric Institute

Illinois Psychiatric Institute
Chicago, Ill.

Illinois Supervising Architect:
Louis H. Gerding
Architects:
Shaw, Metz & Associates, Chicago
Associate Architects and Engineers:
Fugard, Burt, Wilkinson and Orth
Consulting Engineers:
John Dolio & Associates, Chicago
Heating, Air Conditioning Contractor:
Gallaher and Speck, Inc., Chicago
Ventilation: Zack Co., Chicago



JOB DETAILS

The system encompasses 12 temperature zones, each designed to operate independently in relation to individual zone exposure problems. Ten zones utilize ceiling heating and cooling panels at which hot and chilled water circulate from zone exchangers. Three-way control valves for the water are modulated by pneumatic thermostats in various rooms. Two zones — auditorium and stairwell — have only heat exchangers (the auditorium is supplied with individual conditioned air).

Master outdoor controls sense the changes in temperature outdoors and instantly reset submaster pneumatic thermostats at the zone exchangers. These indoor-outdoor controls are engineered for foolproof maintenance of uniform zone temperatures.

A central control board, the heart of the Dolio design, monitors the complete heating, cooling and ventilating system. The building engineer alone can instantly check 170 control points by merely referring to the Powers Graph-O-Matic Control Panel.

Temperature controls are inaccessible to patients. All controls in the corridors are wall-mounted and cabinet-enclosed; temperature sensors are mounted in ceiling exhaust ducts.

Easy servicing and low maintenance are two big reasons why a pneumatic system of control was specified by this engineering firm. Efficiency at low cost is characteristic of this type of control — as it is with the Powers pneumatic system installed here.

Safety and comfort for patients is provided for throughout. For example, in hydrotherapy, in showers, in sitz baths, etc., Powers Hydroguard® thermostatic water controls prevent scalding and eliminate dangerous water temperature fluctuations.

Write for the latest Powers Hospital Catalog.
Write us also for catalog on time-saving, money-saving pneumatic tube systems manufactured by our new subsidiary, the Grover Company.

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DEPT. 461 — SKOKIE 53, ILLINOIS | *Offices in Principal Cities in U.S.A. and Canada*
MANUFACTURERS OF THERMOSTATIC CONTROLS SINCE 1891

R. W. BECK

– *Starts on front cover*

In addition to the Seattle office, R. W. Beck and Associates maintains a major branch office in Columbus, Nebraska, and other branches in Phoenix, Arizona, and Boulder, Colorado. In its present form, the firm dates back to 1954 when Beck formed a partnership with several of his key employees. He now has 10 partners, and expects to have more as younger men prove their worth. The firm is divided into two sections, one for design engineering and the other for analytical engineering. Beck has found that design engineers are usually not good analytical engineers and vice versa. Therefore, men are channeled into the activity for which they have special talents.

Beck's firm currently is dealing largely with public utility districts, municipalities, and other subdivisions of states; public authorities; and REA financed cooperatives. The firm also has done a great deal of work for the United States Navy, Air Force, Corps of Engineers, Atomic Energy Commission, Bureau of Reclamation, and Bonneville Power Administration.

Design activities presently are concentrated in the Seattle and Columbus offices. During the past eight years, this field of activity has undergone a considerable expansion. The design section now includes 45 people, 30 of them registered engineers. Current design activities include electric, water, sewer, steam heat, and telephone systems; as well as hydroelectric and thermal power plants, and water and sewage treatment plants. The design group has engaged in a number of joint ventures, both with architectural firms and other consulting engineering firms. Currently, the firm is engaged in a joint venture with three other consulting firms on the design of a regional sewage disposal system for metropolitan Seattle. This program is scheduled for development over a 10-year period, and the estimated cost is over $100 million.

Views on the Profession

Beck holds some firm convictions on the consulting engineering profession. He feels that it will not attain the high position it deserves in the public mind until students in engineering schools are taught the fundamentals of private practice by professors who are appreciative of the importance of this activity in our economy. According to Beck, there is much to be done for younger members of the profession to help them develop their sense of responsibility to their clients and to each other.

In Beck's opinion, there is too much attention being devoted to the establishment of minimum fee schedules and not enough to the setting of adequate standards of performance. He believes that if standards of performance for engineering services are high enough, the fee problem will solve itself.

Although Beck does not condone the practice of taking work on a contingency basis, there are situations in which the preliminary studies must be made on this basis. This usually happens when new public bodies, such as power, water, or sewer districts, do not have immediate funds. Under these circumstances, the consulting work usually can be done on a cost basis until the bond financing is completed. Since these situations involve firm commitments, Beck considers them sound ventures.

Competitive bidding on private and government work can be eliminated only through a continuous program of education. It will require strong presentations against the practice by such organizations as Consulting Engineers Council at the national level, and the state associations at the local level.

Beck's Early Years

Beck was born in Chicago on June 14, 1896. As a small boy, living in a two-flat apartment building, his interest in engineering was aroused when a neighbor's son enrolled in an engineering college. Young Beck was deeply impressed by the drawings which this student was preparing.

Even though Beck moved to Oregon with his parents at the age of nine, he never forgot his early interest in engineering. He first elected the field of mining engineering. Working nights in the mines, while attending the Montana School of Mines in 1916 and 1917, he contracted a lung ailment which forced him into outdoor work. His work on reconnaissance surveys of hydroelectric dam sites for the Montana Power Company took him into the mountains of Montana, restored his health, and led him to abandon mining for the electric utility business.

After service in France with the U. S. Army Corps of Engineers in World War I, Beck resumed his engineering studies at Oregon State College. His first job after leaving college was as a power plant operator. Later he became a resident engineer on hydroelectric construction in Oregon with the California-Oregon Power Company. During this time he took extension courses in electrical engineering from the Universities of Wisconsin and California. He then served as an engineer with the Seattle City Lighting Department for 13 years, with the Bonneville Power Administration in its formative period for two years, and as general manager of the electric system serving the cities of Aberdeen, Hoquiam, and Cosmopolis, and Grays Harbor County, Washington for two years.

A major turning point in Bob Beck's career came in 1925 when he took a position as distribution engineer with Seattle City Light. It was at this time that he became acquainted with the late J. D. Ross, then superintendent of the Seattle municipal system and later the first member of the newly formed Securities Exchange Commission in charge of holding company

CLIMATE BY CHRYSLER

ROYAL ORLEANS HOTEL, New Orleans, La. Operated by Hotel Corporation of America. **Architect:** Curtis & Davis. **Consulting Engineer:** Cary B. Gamble & Assoc. **Mechanical Contractor:** Emile M. Babst Co.

Temperature in new Royal Orleans Hotel held ±1° F by two Chrysler centrifugal water chillers in series

In a hot, humid climate like that of New Orleans, it's essential to have accurate control over both dry-bulb and dew point temperatures. That's why the new Royal Orleans Hotel decided on a double duct air conditioning system using two Chrysler centrifugal water chillers *in series.*

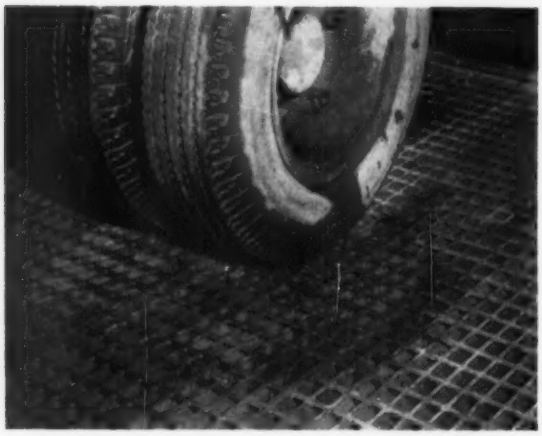
This combination makes it possible to control chilled water temperatures to within 1° F . . . and refrigeration capacity to within 10% of capacity. The double duct system makes available both chilled dehumidified air, and warm air, at every point for accurate, individual room control of temperature and humidity.

Two Chrysler centrifugal water chilling units were selected because they are more efficient . . . they each produce 276 tons, with only .84 brake horsepower per ton. And they're more economical . . . with 20% more chiller and condenser surface available, they reduce power consumption.

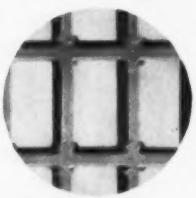
Flexibility, economy, efficiency, control—these are but a few of the reasons Chrysler centrifugal water chilling units and other air conditioning equipment are so often specified in the important jobs. For more information, or the technical co-operation of a Chrysler Engineer, write today.

CHRYSLER AIRTEMP

Chrysler Corporation, Airtemp Division, Dept. AS-41, Dayton 4, Ohio
In Canada: Therm-O-Rite Products, Ltd., Toronto, Ontario



Heavy mobile loadings call for Gary HEAVY-WELD STEEL GRATING



Advanced design of Gary Heavy-Weld Gratings makes them ideal for any installation where heavy-duty open steel flooring is desirable. New design has the capacity to sustain heavy mobile loadings imposed by highway vehicles, lift trucks, and all classes of aircraft. Straight clean lines of the rectangular pattern permit unimpeded flowage and afford maximum open area. Wide range of sizes and meshes makes Gary Heavy-Weld Gratings adaptable for a variety of applications.

- Airfield drainage covers
- Industrial floor openings
- Aggregate screens
- Highway inlets & trenches
- Vehicular ramps
- Trash racks
- Scrubber trays

A New Catalog has a unique series of charts for use in determining the exact size and type of Heavy-Weld Grating for your particular application. Handy tables simplify the problem of specifying exactly the right grating for every load requirement. For your free copy of catalog No. H-760 write today to Dept. D-7.

ROCKWELL-STANDARD CORPORATION

Grating Division, Gary, Indiana

regulations. Ross introduced Beck to the work which became his particular specialty; economic studies of power supply developments, analyses of utility operations, and valuations of utility properties.

During these years, the issue of local public ownership versus private ownership of electric utilities was being hotly debated in the State of Washington, and particularly in Seattle. Beck provided engineering assistance to the Washington State Grange and civic leaders who were active in promoting a state law authorizing the establishment of county-wide utility districts. Later, he provided engineering assistance to most of the districts that were established, and helped to make them going concerns.

First Private Practice

On leave of absence from Seattle City Light from 1936 through 1938, Beck began to engage in private consulting work for municipal electric systems and for the newly formed public utility districts in Nebraska. He evaluated the properties of the electrical utilities in Nebraska and, ultimately, all of the private power companies agreed to sell their property to local public bodies at the fair market values determined by Beck. Together with his partner at that time, James I. Metcalf, Beck prepared the engineering reports which supported the financing of the property purchased by these local public agencies. Today, Nebraska is the only state in the union in which all electric systems are owned by local public bodies. Beck's firm still serves as consulting engineer in Nebraska, working directly for the Consumers Public Power District and the Nebraska Public Power System.

During Beck's first years in Nebraska, the Bonneville Act was passed, and J. D. Ross was named the first administrator of the Bonneville Power Administration. As a result, Beck was named the first principal electrical engineer in charge of system planning and marketing for Bonneville power. He held this post until 1939, when he was engaged by the Grays Harbor County Public Utility District to evaluate the properties of the Grays Harbor Railway and Light Company, and to assist the District in purchasing them — the first purchase of private power company properties in the State of Washington.

After the properties were acquired, Beck served as the District's first general manager. He not only guided the transition of the organization from private ownership to public ownership, but also developed new rates — new in type as well as in basis of charges — new standards of service, and basic principles governing the operations which reflected the new form of ownership. This pattern later served as the basic guide for 30 other acquisitions in the States of Washington and Nebraska, and in other states.

The American Public Power Association, serving public power agencies throughout the nation, and the

NOW... operating room electrical systems can be truly explosion-proof...

Now, in accordance with NFPA Bulletin 56, Crouse-Hinds presents two new flush-mounted, explosion-proof receptacles. Spark-proof and equipped with a washable, vapor-tight plug, they combine the hospital feature of asepsis with the extra protection of a grounded, keyed and flame-tight electrical operating receptacle for use with existing Hubbell type connectors.

The EHP plug is specially keyed so that it is the only plug that will actuate the EHR receptacle. But the EHP plug can also be used in standard non-explosion-proof Hubbell type receptacles. Its 3-wire construction offers the further safety of equipment grounding. All plug air spaces are filled with high-strength, non-conducting Epoxy resin, preventing accumulation of gases or liquids. A pressure-expanded rubber grommet forms a vaportight, water-proof seal at the cord entrance, allowing plug washing without dismantling and rewiring. See your Crouse-Hinds distributor or contact any Crouse-Hinds office for complete details on this important addition to explosion-proof hospital equipment.

New Crouse-Hinds Explosion-Proof Receptacles and Plug for Hospital Anesthesia Rooms.

- UL approved for Class I Group C & D Locations.
- Designed in strict accordance with NFPA No. 56 Para. 2438.
- For new installations, or for low-cost replacement of existing non-explosion-proof receptacles.
- The new EHR receptacle satisfies the need for a previously unavailable piece of equipment.

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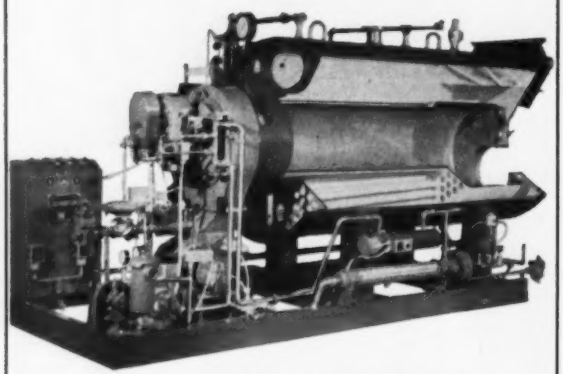
GET THE PLUS FEATURES OF

Johnston

PACKAGED BOILERS



Here's the INSIDE STORY...

— **WATERBACK DESIGN**

Johnston pioneered the waterback design for packaged boilers that eliminated refractory baffles and tube sheet failures due to overheating.

— **UNDIVIDED RESPONSIBILITY**

Johnston Packaged Boilers are completely factory assembled and fire tested before shipment, assuring single responsibility.

— **WIDE CHOICE OF SIZES**

A complete range of sizes from 20 to 750 horsepower, with design pressures to 250 pounds. Quiet, dependable burners for heavy oil, cold oil, gas, or fast, easy change-over combination.

— **LASTING SATISFACTION**

Factory trained technicians inspect and start each installation and train the operators in proper care and maintenance.

— **5 SQ. FT. HEATING SURFACE**

All Johnston Packaged Boilers have full 5 square feet of heating surface per boiler horsepower, A.S.M.E. measured, for long-lived dependability.

For further information write

JOHNSTON BROTHERS, INC.

FERRYSBURG, MICHIGAN

Pioneers of waterback boiler design

Northwest Public Power Association, serving such agencies in the Pacific Northwest, were both organized during this period. Beck was one of the founders, and served on the first board of directors of both organizations.

In 1941, Beck resigned as manager of Grays Harbor County Public Utility District, dissolved his partnership with James Metcalf, and moved to Columbus, Nebraska. Here he still maintains a second home and an important office. This office is engaged primarily in the integration of the 17 separate electric systems acquired by the Nebraska public utility districts and in unifying the numerous and often conflicting organizations and rate structures.

With the Nebraska operations established on a going basis, Beck was called upon to evaluate the electric system serving Key West, Florida. The city and the owners of the company properties accepted his evaluation. Investment bankers relied upon his presentation of engineering and economic feasibility in an engineering report noted for its analysis of the vulnerability of Key West to devastating hurricane forces. As a result of Beck's detailed report, investment bankers financed the purchase of the utility property by the city. Beck's firm continues to serve the City of Key West in a consulting capacity, and has shared responsibility with the city in the design of a steam plant, diesel plant, transmission lines, substations, and improvements and expansion of the distribution system. Similar services were supplied to the City of Lafayette, Louisiana, which operates sewer and water utilities as well as electric services.

In spite of his activities all over the United States, the Pacific Northwest was still home to Beck. In 1946, he opened an office in Seattle, Washington, to supply consulting services to the immediate area and also to Alaska. During the next four years, he evaluated a number of public utility properties which were purchased through amicable negotiations from power companies in the State of Washington. The purchase prices were based upon fair market values developed by Beck. His engineering reports were also the basis for the financing of such acquisitions.

Over the years, R. W. Beck and Associates has prepared reports in support of financing for new construction and refunding which total upward of a billion dollars. In addition to serving numerous clients in many states on a job basis, the firm is employed under continuing contracts by 15 municipalities or public districts in Washington, Florida, Louisiana, Nebraska, New Mexico, Hawaii, and Alaska. These agencies own properties valued at upward of $1 billion, and serve over 250,000 customers.

The siren call of foreign engineering projects has never fallen very heavily on Beck's ears, and he has confined his firm's activities to the United States — including Alaska and Hawaii. Perhaps his reluctance

NEW SARAN LINED DRAIN LINE—won't break or rust out, installs fast with regular plumbers' tools!

This new corrosion-resistant plumbing is handled like ordinary pipe. Install it in ordinary wall sections . . . use regular plumbers' tools and methods . . . and don't baby it. And where space is tight, design of fittings permits use of spanner or strap wrench. Saran lined drain line and fittings *won't break* when you install them, and they stand up to almost *anything* a man might put in them . . . acids, alkalis, radioactive wastes. They won't rust out even after years of service!

Tough saran lined drain line comes in lengths up to ten feet, which means fewer joints in a drain system. You don't have to lead and caulk bell-trap joints. Close coupling nuts on saran lined fittings make assembly quick and easy . . . with a positive, leak-proof seal at every joint! Since saran lined drain line has a tough steel casing, it won't sag or distort, even when using a minimum of supports or hangers.

When you design or specify corrosion-resistant drainage systems for laboratories or chemical operations of any kind, build the complete system with saran lined drain line and fittings. They'll take pressure ranging from full vacuum to 150 psi, and temperatures from —20°F. to 200°F. They can be easily cut, fitted and modified using conventional plumbers' tools. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 1574LW4.

THE DOW CHEMICAL COMPANY DOW Midland, Michigan

So SIMPLE
We Can
Adapt It
to ANY
LIQUID LEVEL
CONTROL JOB
A sleeve, raised and lowered within a non-magnetic tube, attracts or releases an Alnico magnet attached to a mercury switch. Basically, this is Magnetrol.
MAGNETROL

AS DEPENDABLE AS MAGNETIC FORCE ITSELF

● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

Because of the utter simplicity and dependability of its magnetic principle, Magnetrol has *infinite operating life.* There are no wearing parts to get out of order.

Magnetrols are available for controlling level changes from .0025-in. to 150-ft., with single or multi-stage switching. Our experienced engineering staff is at your service.

MAGNETROL, Inc.

WHY NOT MAIL THE COUPON — NOW

MAGNETROL, Inc., 5305 Belmont Road, Downers Grove, Ill.
Please send me catalog and full information on Magnetrol Liquid Level Controls. 7
Name
Company
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to engage in foreign work resulted from an experience he had in preliminary negotiations for a Cuban project. It developed that the client wanted to pay for Beck's services with sugar.

Building a Firm for the Future

Beck has developed his engineering firm for the long haul. In hiring engineering and drafting personnel, he has pursued a policy of careful selection to bring into the organization people with ability, who will grow with experience. In his search for talent, engineers of foreign background have occasionally been added to the staff, as ability and personality are the only criteria he uses in selecting a man for a job. Although he does not employ women as engineers, a number of them have been hired for drafting.

Registration of engineering personnel is encouraged as being essential to advancement in the organization. In the case of out-of-state registration, the firm pays the fee. The firm also pays membership fees of partners in engineering societies, and convention expenses for partners and senior engineers.

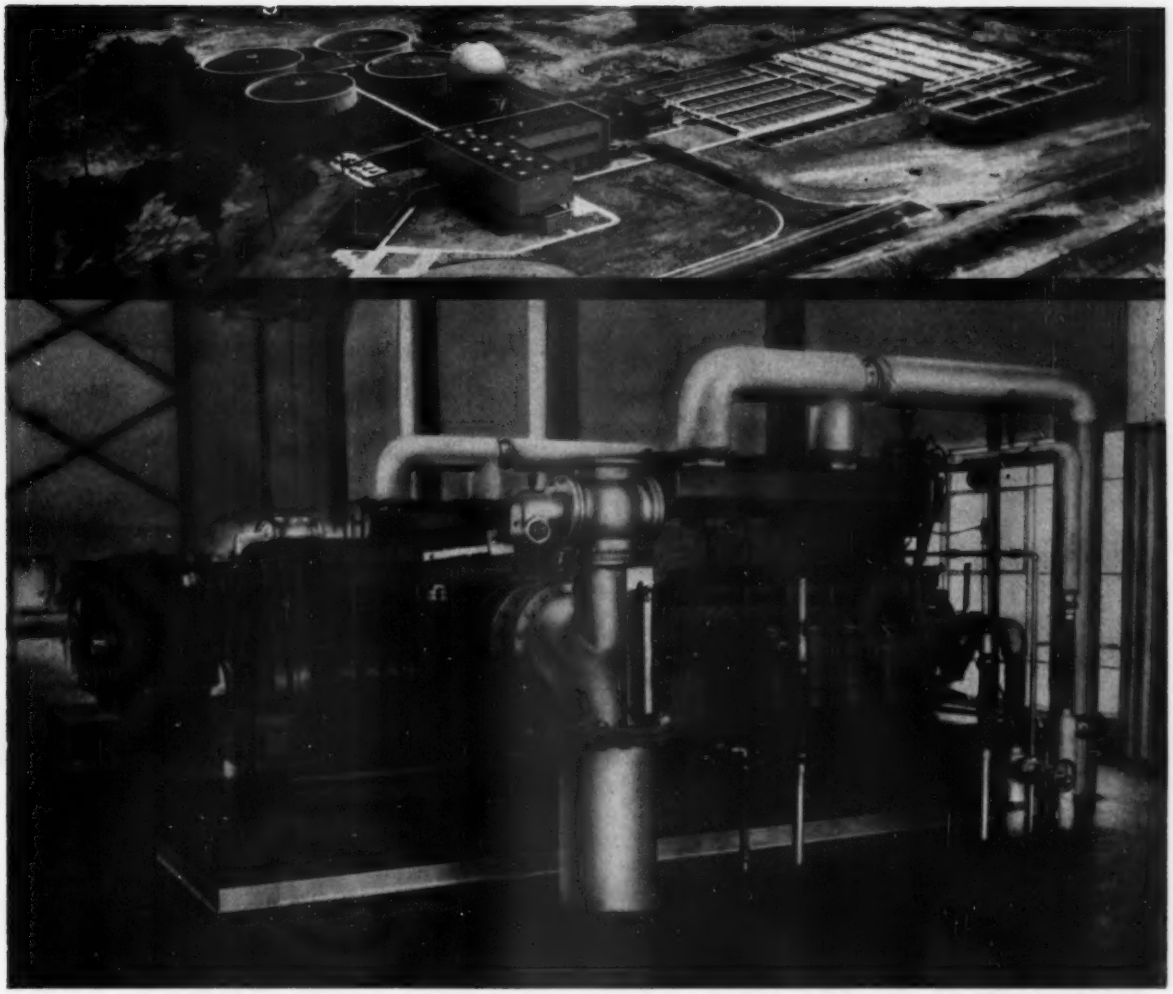
Although no formal training program has been set up for engineers, every encouragement is given for self-improvement. In the field of nuclear power plants, however, the firm did arrange a study program to inform its engineering personnel on developments.

The modern offices and drafting rooms of R. W. Beck and Associates reflect the belief that good equipment and attractive surroundings result in more efficient work. Consideration at one time was given to the purchase of a building for use as a headquarters and engineering office. However, it was finally decided that the present rental facilities were more desirable because of their location close to the financial and business center of Seattle.

All employees and partners share in the firm's profits in some manner. After appropriate provision is made for new equipment, working capital, and other priority charges, a third of the remaining net income is allocated for business expansion, a third is distributed in cash to the partners, and a third is distributed in cash to the senior engineers. All employees are given a substantial cash Christmas bonus, which is based on rating and length of service. It amounts to about half a month's salary for men with five years of service and a full month's salary for 15 years of service.

Professional Society Affiliations

Bob Beck always has been interested in technical and professional society activities. He is a Fellow in the American Institute of Electrical Engineers, and a member of the Consulting Engineers Association of Washington, the Washington Society of Professional Engineers, the Society of American Military Engineers, and the United States Committee of the International Commission on Large Dams. ▲▲



WHITE/SUPERIOR ENGINES OPERATE ON FREE SEWAGE GAS

at Hamilton, Ohio's 12,000,000 gallon per day sewage treatment plant

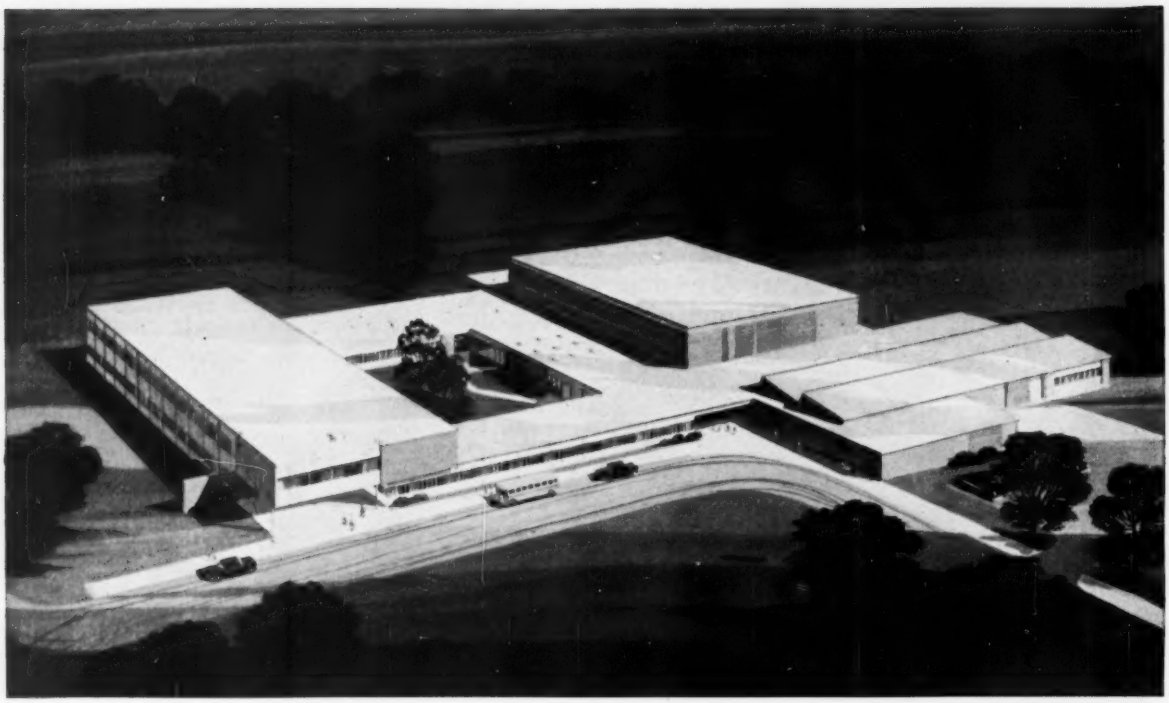
Two White Superior 6G-825 gas engines at Hamilton, Ohio's new activated sludge type sewage treatment plant are saving taxpayers thousands of dollars yearly. Engines operate on free sewage gas produced in the plant digesters. The Superiors, each rated 300 bhp at 690 rpm, drive blowers with a total capacity of 14,000 cfm to aerate sewage. Heat from engine cooling water also helps heat the buildings.

Superiors also feature outstanding design simplicity, with fewer moving parts than comparable power units. Maintenance and repair costs are minimized, and replacement parts are seldom needed, even after extremely long periods of operation.

White Superior covers every municipal power requirement with a complete line of dependable diesel, dual-fuel and gas engines, 190 to 2150 hp, or 150 to 1500 kw. *Write for literature today!* WHITE DIESEL ENGINE DIVISION, Springfield, Ohio.

White DIESEL | Superior ENGINES

White Diesel



In the new Batavia Senior High School, Batavia, New York...

NEW CARRIER HEATING AND VENTILATING SYSTEM PROVIDES 8 MAJOR ADVANTAGES YET COSTS LESS

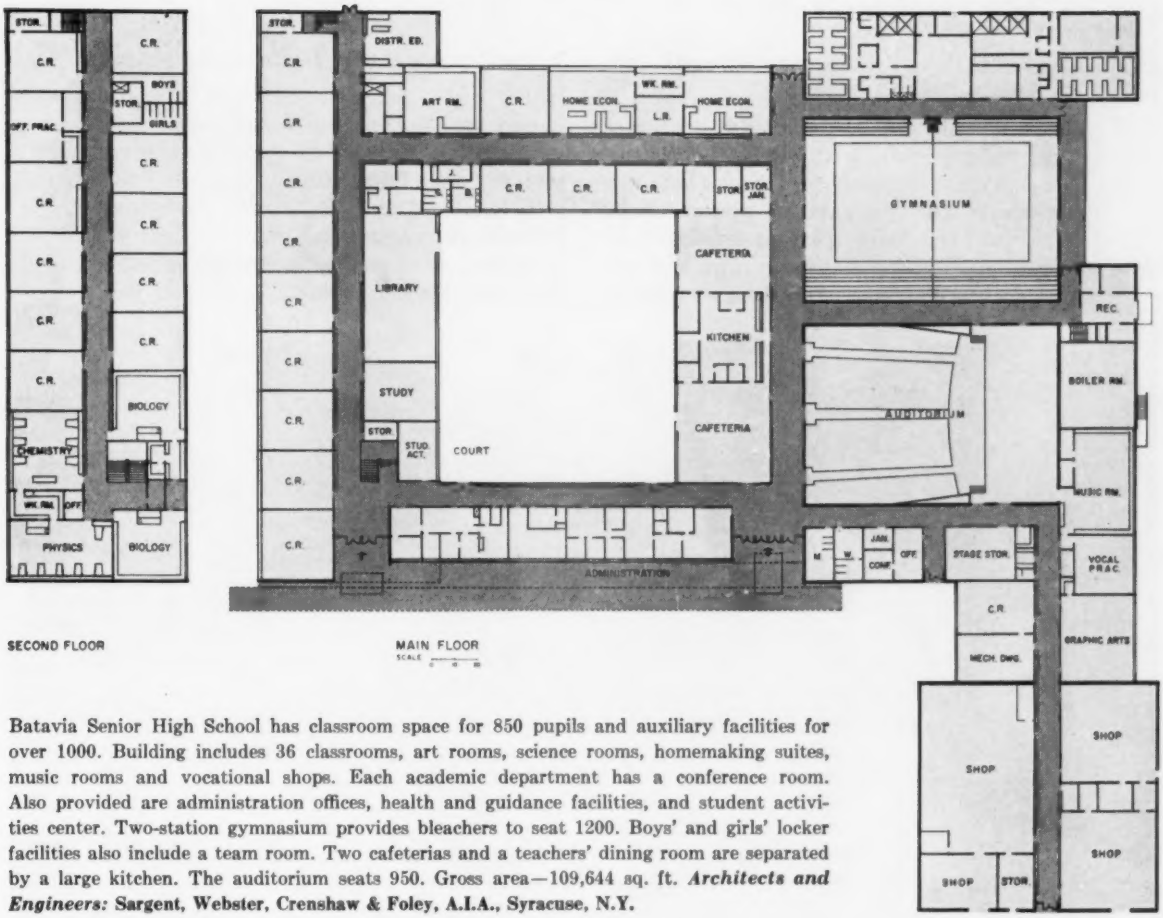
This modern high school offers an excellent example of how any new school can enjoy a superior heating and ventilating system at less than the cost of ordinary unit ventilators. And this new kind of system is ready for immediate conversion to year-round air conditioning with the simple addition of packaged refrigeration equipment in the machine room.

In planning Batavia Senior High, the designers considered unit ventilators and several popular central station systems. They carefully compared the performance characteristics, maintenance requirements, first cost and operating cost of each method. Their conclusion: The new Carrier 37E All-Air Weathermaster* System provides the highest quality automatic heating and ventilation currently available to schools. It is the easiest to convert to complete year-round air conditioning. It costs 10% less, installed, than the next best method. And it costs less to operate and to maintain than other automatic systems.

The eight important advantages of the 37E Weathermaster System which led to these conclusions are listed on the opposite page. They are unique because Carrier 37E units are the only room terminals which combine the performance benefits of the induction principle with either high or low velocity air distribution and the superiorities inherent in all central station systems.

If you are designing a new school, it should be well worth your while to look into the Carrier 37E All-Air Weathermaster System—either for heating and ventilation only, or with an eye to future air conditioning. The nearby Carrier office will be glad to give you complete facts on this advanced system. Or you may write to Carrier Air Conditioning Company, Syracuse 1, New York.

*Reg. U.S. Pat. Off.



Batavia Senior High School has classroom space for 850 pupils and auxiliary facilities for over 1000. Building includes 36 classrooms, art rooms, science rooms, homemaking suites, music rooms and vocational shops. Each academic department has a conference room. Also provided are administration offices, health and guidance facilities, and student activities center. Two-station gymnasium provides bleachers to seat 1200. Boys' and girls' locker facilities also include a team room. Two cafeterias and a teachers' dining room are separated by a large kitchen. The auditorium seats 950. Gross area—109,644 sq. ft. ***Architects and Engineers:*** **Sargent, Webster, Crenshaw & Foley, A.I.A., Syracuse, N.Y.**

Only the Carrier 37E All-Air Weathermaster System offers these 8 advantages for heating and ventilating

1 Positive ventilation and air circulation under all conditions and seasons for improved odor dilution. Constant air volume from units.

2 Quieter operation—no fans or other moving equipment in classrooms, with all powered equipment located in machine room for easy servicing.

3 Superior air filtering at central station—minimum filter maintenance.

4 No costly wall openings, subject to rain and wind leakage, required in classrooms for ventilation air.

5 No operation of fans required for night and week-end heating, with gravity heating handling the load.

6 Individual temperature control in every room solves zoning problems; air damper assures easy initial system balancing, requires no adjustments thereafter.

7 Valuable classroom floor and wall space is saved by the compact units; cabinet only eight inches deep.

8 Easily and economically converts to full-year-round air conditioning at any future date with simple addition of packaged water chilling machine in central apparatus room. No revision of classroom units, controls or air ducts required. Condensate drains not needed. Nominal conversion cost about 65c per sq. ft., or less.

Carrier ***Air Conditioning Company***

POWELL PERFORMANCE PAYS OFF

Any way you look at it, Powell performance really pays off. Take "availability" for instance.

You'll find that Powell makes just about any type of valve you may need—for oil, water, gas, steam, air and corrosive fluid applications. The same holds true for virtually any temperature and pressure. What's more, you'll find Powell valves are available in industry's widest selection of bronze, iron, steel and special alloys—from aluminum to zirconium. (The fact is, Powell pioneered application of special alloys in valve design.)

In short, you'll find Powell performance also includes outstanding availability—of exactly the type valve you need. And, since Powell maintains large stocks both at the factory and key points across the country—you get exactly what you need, when you need it. For further information, contact your nearby Powell Valve distributor or write The Wm. Powell Co., Cincinnati 22, Ohio.

125-pound All Iron Gate Valve. Outside screw rising stem and yoke. Flanged ends, 2" through 30". Screwed ends, 2" through 8". Iron body bronze mounted valves also available.

175-pound W.O.G. Semi-Steel flanged and Lubricated Plug Valve. Wrench operated. Sizes 1" through 4". Available also with screwed ends. Catalog of complete line on request.

125-pound Iron Body Bronze Mounted Swing Check Valve. Bolted flanged cap. Can be used in either horizontal or vertical position. Sizes, flanged, 2" through 18"; screwed, 2" through 4". Can also be furnished in all iron.

115th year of manufacturing industrial valves for the free world

POWELL DEPENDABLE VALVES

THE WM. POWELL COMPANY CINCINNATI 22, OHIO

Readers' Comment

Large Dams — Author's Comments

Thank you for the February issue of CONSULTING ENGINEER which carried my article, "Large Dams — Their Engineering Significance." I am pleased with the excellent editing and presentation of the article.

One small omission, however, needs to be corrected. On page 85 the fourth line from the bottom should read "gravity dam designed for 0.10g horizontal earthquake." The g stands for acceleration of gravity.

Also, could you please print the following credits for photographs used in the article:

Vaiont Dam — Societa Adriatica Di Elettricita, Venice

Hungry Horse and Grand Coulee Dams — the U. S. Bureau of Reclamation

Brownlee Dam — International Engineering Co., Inc.

Mauvoisin Dam — Electro-Watt, Zurich

G. S. Sarkaria
International Engineering Co.

Specialization

In reading the article, "Survey of the Profession — 1961," in the February issue of CONSULTING ENGINEER, I experienced a negative reaction to the positive statement on your part, "When a client goes to an architect, he expects to have the project handled by one firm. He does not go to one architect for the church and another for the steeple." By your statement, there seems little doubt in your mind that a client receives a better coordinated project when all engineering services are provided by the same organization.

Although engineering services on a construction project have many things in common, the complexity of design in each of the services requires the knowledge, experience, and insistence of cooperative recognition which cannot be obtained in any form of a package plan. As the size of organization increases, the final decision more often rests in the hands of an over-all authority, and the separate services, lacking final authority, often are required to compromise conditions against their better judgment.

The independent engineering office, uninhibited by this compromising authority, will insist on proper recognition of its engineering service and, in the final result, the total project will reach a greater degree of perfection. To say that separate offices, limiting their service to one branch of engineering, cannot provide the coordination of a package plan infers that coordination, in itself, is such a complex problem that one must be breathing down the other's neck to accomplish it. In many cases, remote coordination attains a perfection seldom accomplished by close coordination because the medium of

TEMPRITE
WATER COOLERS
FIT SNUG
TO THE WALL

ARCHITECTURAL EFFICIENCY . . . Plumbing connections concealed within cooler cabinet. Saves floor space. Minimizes cleaning.

BEAUTIFUL STYLING . . . Smart "WF" models by Temprite offer sculptured styling at its best.

STAINLESS STEEL TOP . . . Smoothly contoured, polished stainless steel. Extra-deep basin; anti-splash design.

CONSULT YELLOW PAGES UNDER "WATER COOLERS", OR WRITE
TEMPRITE PRODUCTS CORPORATION
BOX 72E, BIRMINGHAM, MICHIGAN

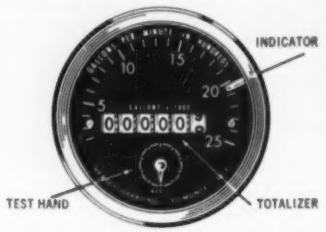
Rush me details on Temprite Drinking Water Coolers.
Name_____
Company_____
Address_____
City_____ State_____

SPARLING METERING TOPICS

Direct Totalization at a Glance with Propeller Meters

NO CONVERSION REQUIRED... Direct totalization is the primary function of a propeller meter. Continuous and reliable total flow information is provided instantly, without need of conversion tables or additional instrumentation.

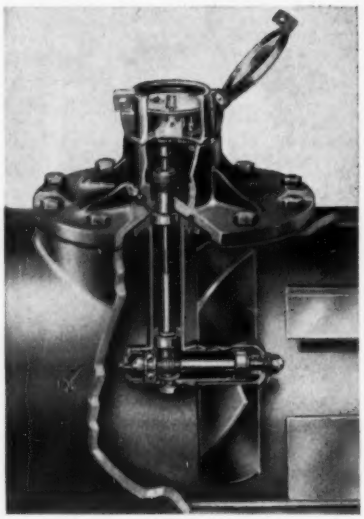
Totalization results from a simple mechanical operation. A propeller suspended in the center of a straight tube is turned by the kinetic energy of the moving liquid and rotates in direct relation to the flow velocity. Through a basic shaft and gear mechanism, the propeller rotation produces the exact volumetric figures on a straight-reading, 6-digit totalizer that may be read directly at the meter itself or transmitted to remote locations.



Where rate of flow as well as direct totalization is desired Sparling provides a combination indicator-totalizer that shows both simultaneously.

ASSURED ACCURACY...When properly installed, propeller meters register within 2% accuracy at all flows within the rated range of the meter. Sparling uses rugged, resilient plastic propellers that hold the precise pitch and set of the blades for the life of the propeller to guarantee continuing accuracy.

INSTALLATION VERSATILITY... Sparling meters can be located at any desired angle and still function with the same accuracy. They may be installed at either pump suction or discharge, and are unaffected by variation in pressures.



Meter head assembly can be readily removed for periodic inspection.

DURABLE... Moving parts in a propeller meter are few. They consist of worm and worm gear, shafts, change gears and bearings. The meters are designed and engineered to maintain exacting tolerances and to operate accurately even after years of continuous wear.

NEGLIGIBLE HEAD LOSS...The straight bore of a Sparling meter tube presents no obstruction, so flow is never distorted or constricted; hence, need for pressure recovery is eliminated. Pressure loss for a standard 8" Sparling meter is less than 3" at normal flows.

WIDE AVAILABILITY...There is a complete range of Sparling propeller meters, instruments and control equipment to meet any main-line metering requirement. Ask your Sparling field representative for further information, or WRITE FOR CATALOG 315CE.

SPARLING WATER CONTROL EQUIPMENT

HERSEY-SPARLING
METER COMPANY
Sparling Equipment: EL MONTE, CALIF.
225 North Temple City Blvd.
Atlanta · Chicago · Cleveland · Dallas · Denver · Kansas City, Mo. · Roselle, N. J. · San Francisco · Seattle
United Kingdom Affiliate: TYLORS OF LONDON LTD.

transfer of opinion must be clear and complete. Close association all too frequently takes coordination for granted.

It seems to the writer that your over-all viewpoint is in conflict, for, at times, we read of the criticism of the package construction and engineering groups and the wishful comparison of the engineering profession to the medical profession.

After 15 years of combined mechanical and electrical service work, I now maintain an office providing solely electrical and illuminating engineering. I am confident my clients now receive a more intimate service that is better coordinated to the ultimate benefit of all parties concerned.

I believe that the desire on the part of engineers to provide diversified services is more often an effort to increase gross sales and thereby increase total net income because of the reducing trend of net profit and the possibility of increasing volume without increasing the number of sales contacts.

John F. Maguire, Jr., President
Massachusetts Association of
Consulting Engineers, Inc.

Transposed Names

In the February 1961 issue of CONSULTING ENGINEER, page 164, you have switched the names and photographs of Mr. Metz and Mr. Poppino.

John P. Gnaedinger
Soil Testing Services, Inc.

Transformed Citizen

The December 1960 issue of CONSULTING ENGINEER contained a very interesting article on underground structures, including an excellent review of underground hydroelectric plants. It also included what I consider an unfair and inaccurate statement:

On page 111 you say, " . . . while it is true that our power companies are backward in recognizing some important advantages of underground plants, a number of U. S. consulting engineers not only are

"I hate to spend money on switchgear maintenance!"

Who doesn't. That's why I-T-E designed this completely new 13.8 kv switchgear so that your maintenance costs can be lower than ever.

For example, this is the first 13.8 kv switchgear designed exclusively for stored energy closing. That means it closes fast every time. Contacts last longer, and that keeps down the upkeep. I-T-E's unique ratchet and pawl stored energy mechanism eliminates the need for a brake or clutch which would require periodic maintenance.

The breaker is more compact and actually hundreds of pounds lighter in weight than the previous model. So it's easier to move around, has a lower center of gravity. And one man can do all the maintenance work, including raising the arc chutes and maneuvering the frame.

All secondary wiring is in the front—away from the high voltage bus. You can service it without shutting down the board. Access to instruments is through a separate door to an isolated compartment, for still greater safety.

Low-cost maintenance is only one of the economy features of this new I-T-E 13.8 kv switchgear. It saves space—roughly 30 cu. ft. per frame. Stored energy means you can use a smaller battery or transformer for closing. And you can disconnect the breaker without opening the front doors—saving time in routine operations.

If you are about to specify 13.8 kv switchgear, make sure you get all the advantages only this I-T-E equipment offers. See the new illustrated Bulletin 2800-2B. Call your nearby I-T-E sales office. Or write I-T-E Circuit Breaker Company, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

TYPE GP
CLOSE-COUPLED
CENTRIFUGAL

CUT PUMP COSTS

USE AURORA CENTRI-PAC PUMPS

CAPACITIES TO 400 GPM / HEADS TO 150 FEET

NOW AVAILABLE IN 11 PACKAGED SIZES

AIR CONDITIONING EQUIPMENT / CIRCULATING SERVICES / GENERAL SERVICES

- LOWER IN COST . . . made possible by standardization of most popular sizes packaged and stocked for immediate off-the-shelf shipment.
- EXTREMELY COMPACT . . . close-coupled design saves valuable space and is more easily installed.
- HIGHLY EFFICIENT . . . low horsepower requirement means less initial cost and lower operating expense.
- EASILY MAINTAINED . . . pump can be completely disassembled for inspection and repair without disturbing the piping.
- QUALITY CONSTRUCTION . . . bronze fitted, mechanical seals, drip-proof NEMA rated motor with stainless steel shaft and built-in overload protection, and cast bronze impeller keyed and locked in position.
- SMOOTH, QUIET OPERATION . . . low NPSH meets critical suction conditions.

You may also select from a complete line of horizontal or vertical mounted pumps and flexible-coupled pedestal-mounted pumps engineered to your specific requirements.

WRITE FOR BULLETIN 117 PKG

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
700 LOUCKS • AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

abreast of current developments — they are leaders in the field." I agree with your favorable comments on our consulting engineers because I believe it is true. I do not agree with your less than favorable comments on our power companies. Could you please explain how you reached the negative conclusion regarding power companies?

J. Barry Cooke
Supervising Civil Engineer
Pacific Gas and Electric Company

We apologize for what was an unfair and inaccurate statement, particularly since it could reflect on Pacific Gas and Electric Company, which has done an outstanding job in its underground plants. What began as a criticism of government policy was garbled in final editing.

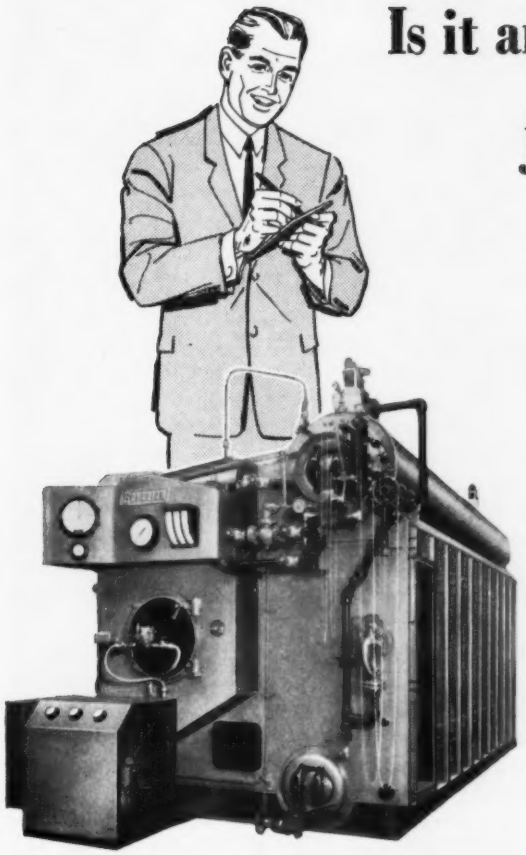
Maryland Board Is Solvent!

The Maryland State Board of Registration for Professional Engineers and Land Surveyors wishes to call to your attention the fact that in your January 1961 issue, you published a statement which is erroneous. The statement is in the "Heard Around Headquarters" column, under the heading, "The Maryland Case," and reads as follows: "Ruth's case was further complicated by the lack of funds of the Maryland registration board. For a period last year, the board had received no funds from the legislature. Thus, it was impossible for a person to become registered. This situation has been corrected."

The Maryland Board is at a loss to understand how such a statement originated, inasmuch as the Board operates from special funds and is not dependent upon any appropriation from the Maryland State Legislature. Will you kindly see that this correction is properly recognized and published.

Thomas F. Hubbard
Executive Secretary
Maryland Board of Registration
for Professional Engineers and
Land Surveyors

Before you buy a "packaged" boiler... ask yourself this question...

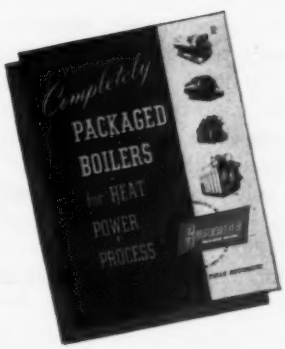


Is it an integrated package . . . or just a boiler with a burner? . . . or who stands behind its promised performance?

Ask specifically if the combustion safety controls and combustion control systems are engineered as part of the "packaged" boiler. Question the capacity of the forced draft fan . . . will the wind box provide air cooling for at least 80% of the boiler firing wall? Have all the critical components been engineered and assembled as part of the packaged boiler by the boiler manufacturer, or have they been sub-contracted, eliminating unit responsibility?

Every Superior Packaged Boiler is a completely integrated and engineered unit, backed by the undivided responsibility of its maker.

Since unit responsibility is basic to "packaged" boilers . . . and you pay for it, be certain you obtain it.



Superior Packaged Boilers of the water-tube type are designed for capacities from 4,000 to 61,000 lbs./hr., and are fired by gas, oil or both. The catalog illustrated provides condensed data on the world's most complete line of packaged boilers. Request catalog S-13

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From the Editor's

Tranquil Tower

Out Damned Spot!

IT IS HARD to lay the ghost of professional misconduct, for the professional is, by his own admission, no ordinary mortal. Thus, it was inevitable that the United States District Court of Massachusetts case of *The United States v. Thomas Worcester* would make the headlines. That it did so in *The Atlantic*, March 1961 issue, was cause for hope that the private practice of engineering would be presented, if not with sympathy, at least with understanding. Unfortunately, this hope was not to be realized.

Thomas Worcester was indicted for income tax evasion on March 13, 1957. Over three years later he was convicted by a Boston jury after a 13-day trial. His 18-month jail sentence was suspended when he agreed to testify with candor before various investigative bodies, including the grand jury. Testimony at the trial revealed that the engineering firm of Thomas Worcester, Inc. had paid out in bribes some $275,000, or exactly 10 percent, of the $2.75 million in highway contracts that Frank Norton, "Assistant to the President," had obtained for the engineering firm from the Massachusetts Department of Public Works and other public bodies.

There is no question of Worcester's guilt. He cannot be excused because testimony implicated other professionals, including members of the bar and judges on the bench. And there is little comfort in the fact that the presiding judge described Worcester as an "otherwise decent man."

But there is a greater guilt than Worcester's – the failure of the consulting engineering profession to explain itself to the public. It must be presumed that Charles L. Whipple, the Boston *Globe* reporter who did the *Atlantic* piece, is a competent writer. Yet he seems unable or unwilling to recognize any of the professional aspects of the private practice of engineering – assuming he writes without prejudice.

The *Atlantic* article is riddled with references to Worcester as a "contractor." There is the usual unadorned statement that "Competitive bidding is not required on contracts with consulting engineers." And, as the clincher, that "Primarily an engineer, Worcester was not required to file a performance bond on each state contract."

It is a little too much to expect that Whipple's readers will see in these casual remarks anything but condemnation of the profession. The implication is clear, whether by accident or intent. It is a characteristic quirk of the uninformed mind that that which is not understood is evil.

It is futile to point out that most consulting engineers are good men; that the highway scandals which have made the headlines seldom involve consulting engineers; or that it is unfortunately true that only a small fraction of our highways are designed by consulting engineers.

What is more important is to let the public know who the consulting engineer is and what he does. The profession must step out from behind the deep shadows cast by the architect, the contractor, and the important client. It must point with pride to the tall buildings' which stand up because consulting engineers designed them to do so; to the streams that run clear, because consulting engineers have designed the sewage treatment plants which filter out contamination; to the hospitals, where patients' chances for survival have improved, because consulting engineers have made them cleaner and more comfortable with better air conditioning systems.

When this is done, and only when this is done, will consulting engineers have wiped out the "damned spot" of their guilt in failing to tell the story of their own important contributions to the public health, safety, and welfare. ▲▲

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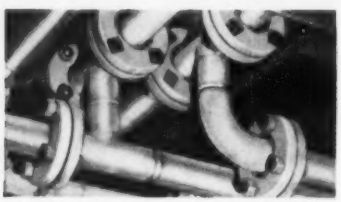

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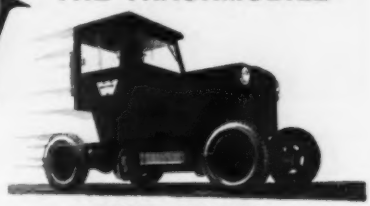

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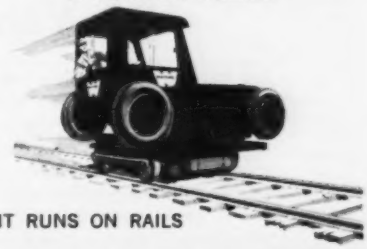

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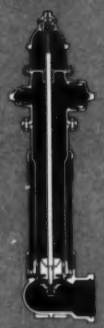
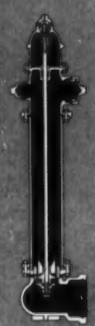


R. D. Wood Mathews Modernized Hydrant with replaceable barrel.



R. D. Wood Mathews Flange Barrel Hydrant . . . dry head construction keeps it operating in every kind of weather.

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Heard Around Headquarters

MARJORIE ODEN

Eastern Editor

Montana Union

The National Society of Professional Engineers is lending its support to the Montana Society to fight the recent unionization of State Highway Department employees. An agreement is reported to have been signed, without an election, by the State Highway Department and the AFL-CIO, for compulsory union membership of engineering employees.

Engineering Headquarters

People around headquarters, at press time, kept saying they were not nervous. The sale of the old building, for $1.5 million, was to have been finalized shortly after the first of the year. To date, nothing has been signed.

Meanwhile, in the next block, the Engineering Club has 30 more days to lean on the West wall they do not own. In January, the Club was given official notice on their loss of the wall, in accordance with an old agreement. Of course, they are expected to make an agreement on the common wall with the new headquarters owners, but right now no one can do anything about it.

Col. Clarence E. Davies, who retired from the American Society of Mechanical Engineers about three years ago, has just retired again — this time from his post as executive director for the United Engineering Trustees new building project. However, UET officials said Col. Davies is expected to continue to work on matters pertaining to the new building.

When the new headquarters is finished, there will be a bright spot on the ninth floor. The building has been designed for 75 foot-candles, but since 150 is the recommended minimum of the Illuminating Engineering Society, IES has paid extra to have its portion of the ninth floor brought up to 200 foot-candles.

Confusion on the Corporate Front

New York State is accustomed to annual battles on corporate practice, but Senator John P. Morrissey threw them for a loop recently. He introduced two bills on the same day — one opposing corporate practice and the other advocating corporate practice.

The Senator said there is no conflict in his views. He merely is tired of the annual debates, and wrote the bill favoring corporate practice in a way, he says, to show how ridiculous the idea of allowing corporations to practice engineering really is. His bill not only allows corporations or partnerships to practice engineering, but adds that he would not impair the rights of offering engineering to the public by "architects, lawyers, doctors, dentists, veterinarians, pharmacists, optometrists, podiatrists, nurses,

FLUIDICS
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Water treatment news for the consulting engineer

Sidestream Filtration
a new approach to an old cooling tower problem

by
Eugene D. Driscoll
M.S., Sanitary Engineering
Permutit
Technical Staff

Silt often causes havoc in cooling systems. It fouls heat exchangers, impairs transfer rates, fosters corrosion, and creates an expensive cleanup problem.

Sidestream Filtration has proved to be a very practical and effective solution to this problem. One week after Phillips Chemical Co. put such a system into operation at Etter, Texas – the suspended matter concentration in their cooling cycle had dropped from 2.0 ppm to 0.5 ppm. In subsequent operations it has dropped to barely detectable amounts.

At this plant, 1 to 5% of the total cooling water flow is diverted, and this "sidestream" then passed through one of our Automatic Valveless Gravity Filters. Treatment of this small portion has been found sufficient to reduce turbidity in the entire cooling system and maintain it at extremely low levels.

Maintenance Requirements: Sidestream filtration does not add to makeup requirements. If suspended solids buildup controls the blowdown cycle, the filter will reduce the blowdown volume appreciably. Because the Valveless Filter washes itself whenever head loss reaches a given level, blowdown of suspended solids is automatically regulated by the silt load, rather than by arbitrary criteria (e.g. time, gallons of water). Where influence of dissolved solids is predominant, the wash water discarded constitutes a part of the normal blowdown requirement and does not increase wastage of water.

Operating Costs: Sidestream filtration need not add to operating costs. By taking the "sidestream" from the discharge of the cooling water service pump, and returning the filtered effluent to the "cold well" which serves this pump, the necessity of additional pumping facilities is avoided. Use of a coagulant has not been found necessary, and the Valveless Filter itself requires no external source of power or regular supervision.

We would welcome your questions or observations about this new sidestream cooling practice. If you want additional information on this or other water treatment applications please call us.

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public or certified public accountants, shorthand reporters, or any other professional persons."

It is hoped that the Senator will keep a tight rein on his bill to prevent its passage in the end-of-the-session confusion.

New Research Policy

The American Society of Mechanical Engineers has revised its policy on research contracts specifically to omit the possibility of research committee members granting work to themselves.

As the policy statement explains, "Frequently ASME research committees have considered or proposed the award of a research contract to a contractor who is, or is represented by, a member of the research committee. The prevalence of such proposals is entirely natural, because each research committee wisely seeks members who are most knowledgeable in the specific field concerned. Such an award, however, invokes or suggests a conflict of interest between the committee and the contractor, on the part of the member who plays the dual role. Of course, it is not impossible to resolve such a conflict of interest satisfactorily in a particular case, but this is difficult at best and precludes concentration of attention upon the research program itself. Failure to resolve this conflict of interest satisfactorily inevitably introduces a serious hazard of partial or complete failure of the program, which would discourage contributors from support of other Society-sponsored research and detract from the Society's prestige."

The statement adds that "cooperative, not competitive" methods should be worked out with other societies or with universities working on similar problems.

Russian Reports

Next October the American Institute of Chemical Engineers will begin publication of technical papers written by chemical engineers in Russia, Eastern and Central Europe, and Red China. These selected works will be printed in a new quarterly journal, with Waldo Hoffman (who will leave his post at *Chemical Engineering Progress* to take the job) as editor.

New ICOLD Member

At the 27th annual meeting of the International Commission on Large Dams in Tokyo, the Argentine National Committee was admitted to membership, becoming the 45th member country. It also was announced that the Union of South Africa plans to submit an application for membership prior to the 1961 Congress in Rome, June 27.

Model Law Comments

Those organizations, such as the Consulting Engineers Council and the American Institute of Consulting Engineers, objecting to the Model Law because it opens the

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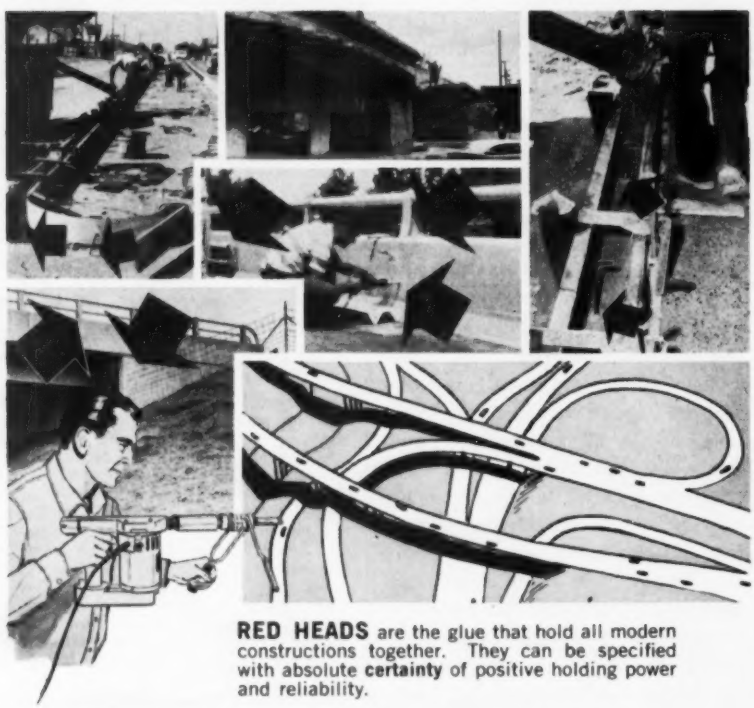

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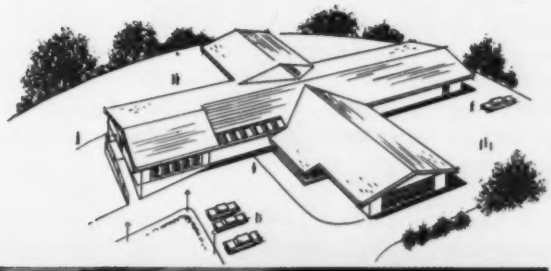
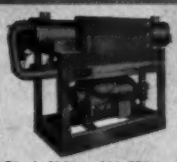


Architect: Albert W. Kahl, San Mateo, California



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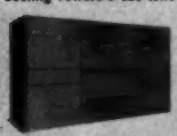

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J. D. Preston, hospital maintenance engineer . . . "I am more than pleased with the operation of our Acme system —both in its heating and cooling efficiency and its low maintenance cost."

These men . . . each one a well-qualified expert in his field on the subject of air conditioning . . . are *sold* on Acme. Their reasons why, important to them from a professional standpoint, are equally important to building owners as well.

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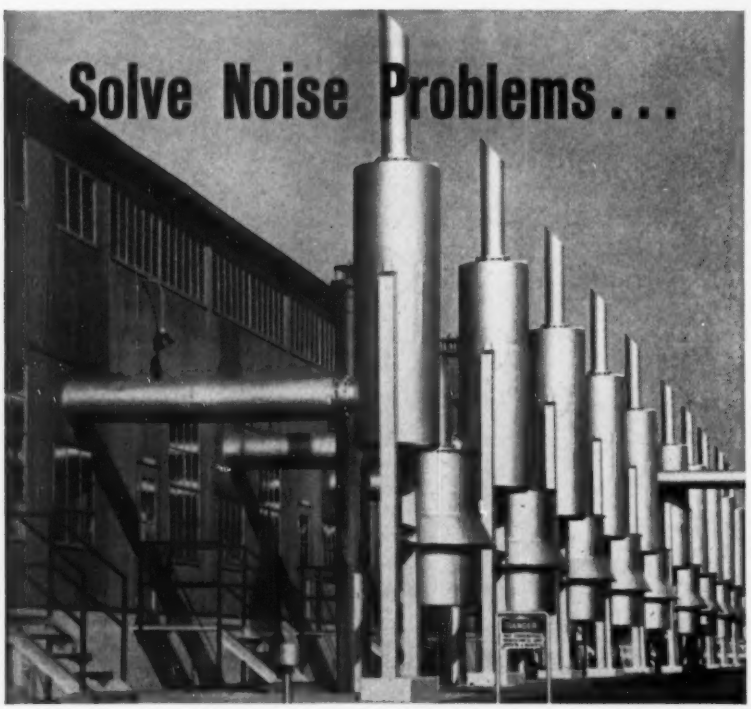
door to corporate practice might be surprised to note that the Committee on Engineering Laws feels that corporate practice under the Model Law might be illegal.

"Comments on a Model Law," being circulated by CEL, states that "The basic difficulty with [the Model Law] is that it neither exempts corporations, partnerships, or other forms of business organization from the prohibitions in the Model Law nor does it authorize them to do anything in the engineering field. As written it simply authorizes the practice of engineering by individual registered professional engineers through such forms of organization. Inasmuch as it would be made unlawful . . . for any person to practice engineering unless he has been duly registered or exempted under the provisions of the Model Law and since under the laws of almost all jurisdictions the word 'person' is construed or defined as including a corporation, an engineering corporation attempting to operate under the language of this subsection as drawn would in our opinion be operating illegally, because corporations are neither entitled to registration under the proposed Model Law nor are they exempted from the provisions of the law under the language . . . which applies to individuals."

CEL thinks substitution of the word "individual" in place of "person" would help.



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Oppose National Science Academy

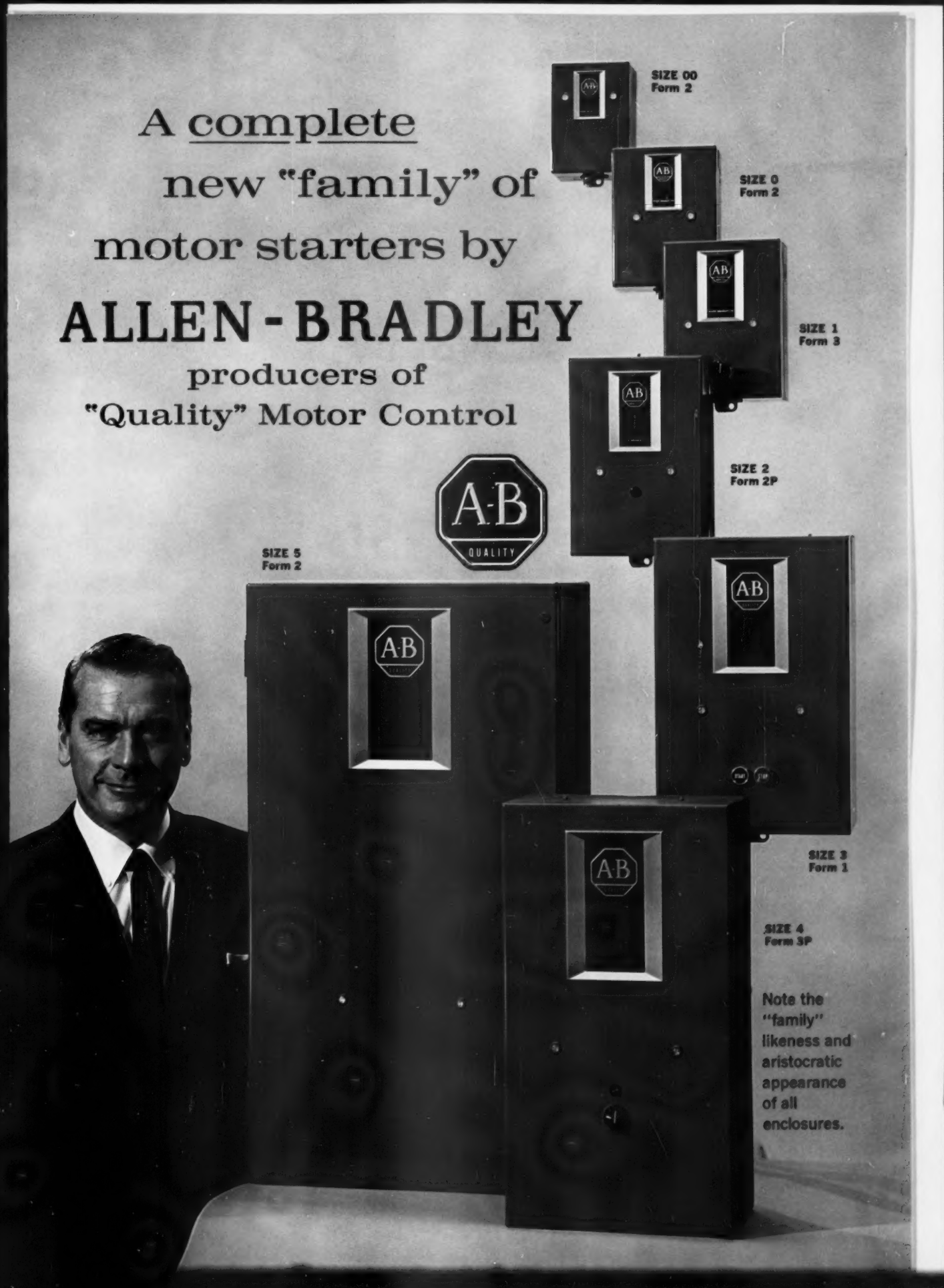
The National Society of Professional Engineers has come out against the proposed formation of a National Science Academy, explaining that, "There is no need, as far as we can determine, for the Federal government to spend time, effort, and money to establish an Academy for the undergraduate and graduate education of engineers and scientists."

Paul Robbins, executive director, added "A Federally-sponsored institution of higher learning only would serve to duplicate facilities, to say nothing of the drain the proposed Academy would have on the already short supply of qualified instructors and professors."

Phoenix Convention

Consulting engineers interested in public vs. private design of highways might want to attend some of the Engineers in Public Practice sessions at the American Society of Civil Engineers convention in Phoenix this month. The highway department engineers will be discussing "Problems Affecting the Effectiveness of Engineers in Public Practice" and "Measures of the Effectiveness of Engineers in Public Practice."

Other topics of interest to the consultants will be sessions of the Conditions of Practice Committee on the Model Law, corporate practice, and the place of land surveyors in registration laws.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New weld-resistant, cadmium oxide silver contacts close and seat firmly, eliminating the sliding motion that causes wear. The overload relays are also **new** and are not only completely *trip-free* but also *tamperproof*. Of course, they were designed to use the **old** Bulletin 709 heating elements you have in stock.

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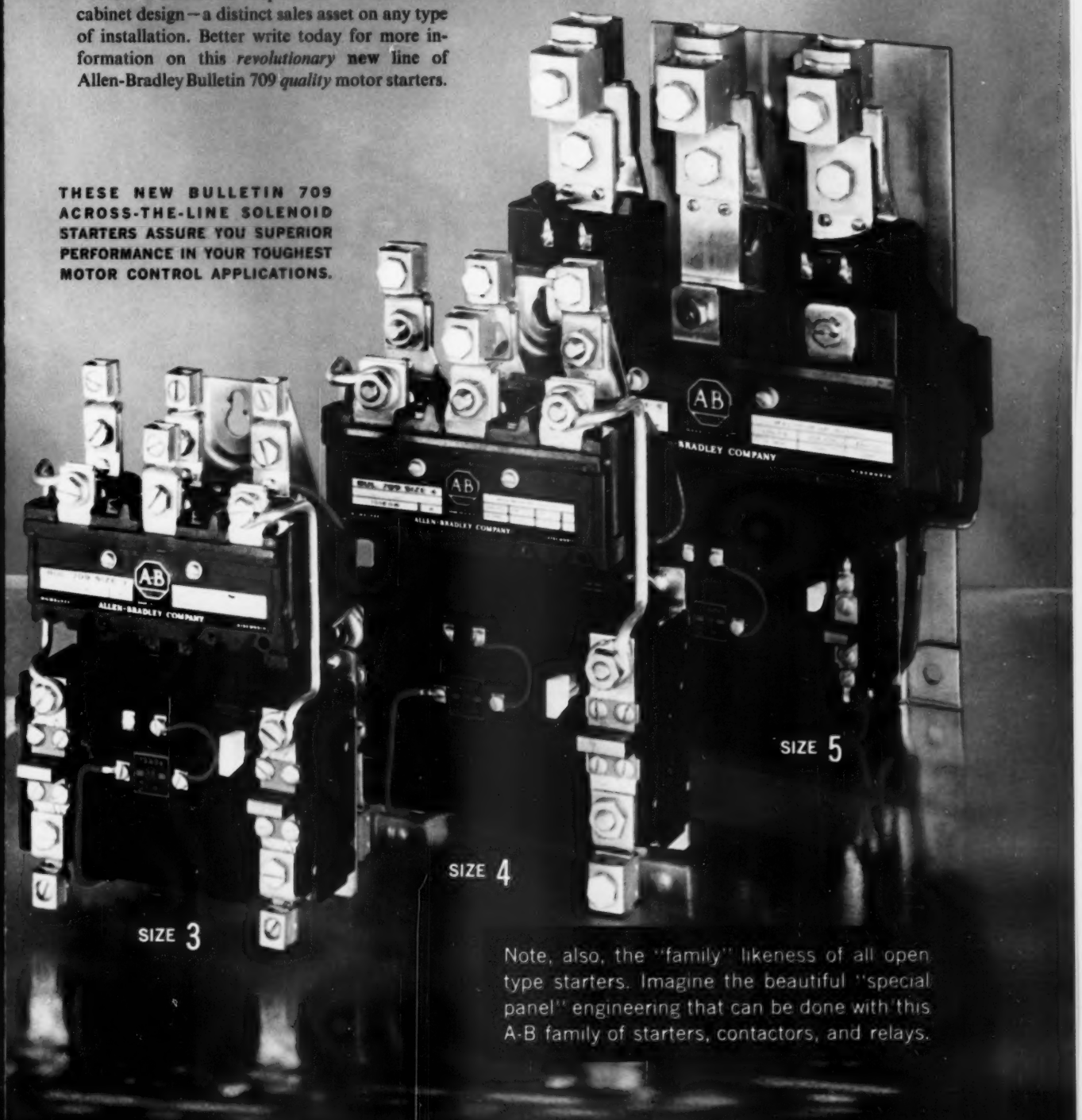
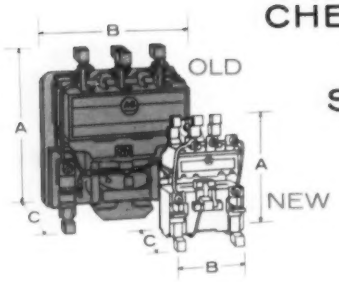
THESE NEW BULLETIN 709 ACROSS-THE-LINE SOLENOID STARTERS ASSURE YOU SUPERIOR PERFORMANCE IN YOUR TOUGHEST MOTOR CONTROL APPLICATIONS.

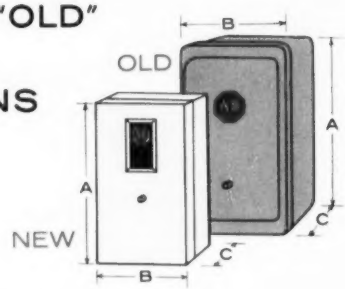


Note, also, the "family" likeness of all open type starters. Imagine the beautiful "special panel" engineering that can be done with this A-B family of starters, contactors, and relays.



CHECK THE "NEW" WITH THE "OLD" BULLETIN 709 SPACE-SAVING DIMENSIONS

The wiring room in the new enclosure will delight the electrician.



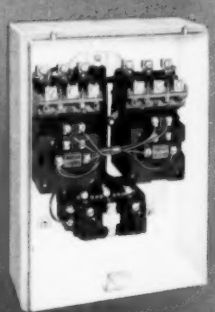
TOTAL OVER-ALL DIMENSIONS

Starter Size	OPEN TYPE STARTERS						NEMA 1 ENCLOSURES					
	NEW			OLD			NEW			OLD		
	Height A	Width B	Depth C	Height A	Width B	Depth C	Height A	Width B	Depth C	Height A	Width B	Depth C
00	3 5/8	3 7/8	3 9/16	—	—	—	7 5/8	4 7/8	4 1/4	—	—	—
0	5 7/8	4 1/16	3 11/16	5 5/8	4 3/4	3 1/4	9 1/8	6 5/16	4 3/8	7 7/8	5 5/8	4 1/4
1	6 5/8	4 1/2	3 11/16	5 7/8	5	3 1/4	10	6 13/16	4 3/8	8 13/16	6 3/8	4 1/4
2	7 3/4	4 5/8	3 11/16	10 1/16	5 3/4	4 7/32	12	7 5/8	4 3/8	14 1/2	9	5 7/16
3	10 1/4	6 1/4	5 7/16	12 5/8	7 1/4	5 7/16	16 5/8	10 3/8	7	19 1/2	11 3/8	6 11/16
4	11 7/16	7 5/16	6 1/4	16 1/4	12 3/4	6 13/16	22	11 5/8	8	26 9/16	14 3/16	7 11/16
5	14 13/16	9	6 1/2	20	16 1/8	8 3/4	32 3/16	17 3/16	9 7/8	41 1/2	19 9/16	13 9/16

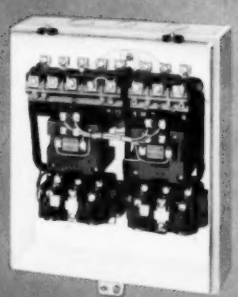
Also...other across-the-line starters in the NEW A-B design!

BULLETIN 712
Size 1 Form 2F
Fused Disconnect

BULLETIN 713
Size 2 Style RT
Circuit Breaker



BULLETIN 705
Size 1 Style RT
With Overload Relays



BULLETIN 715
Size 1 Two Speed
Consequent Pole

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A-B QUALITY

MARJORIE ODEN,
Eastern Editor

New Concrete Code

Field Notes

THE NEW YORK CITY Buildings Department and the concrete industry have cooperated to produce a new concrete code that will be a model for the nation. William Eipel, chairman of the Concrete Industry Board Committee which drew up the Code, explained, "When the final Code is adopted, an engineer will be limited in design of concrete structures only by his own imagination and by some of the strictest safety measures in the nation." This code, 10 years in the making, will come as a great relief to New York City consultants, who are accustomed to thumbing through 200 pages of the current code to find the scattered rules, regulations, and definitions affecting concrete design.

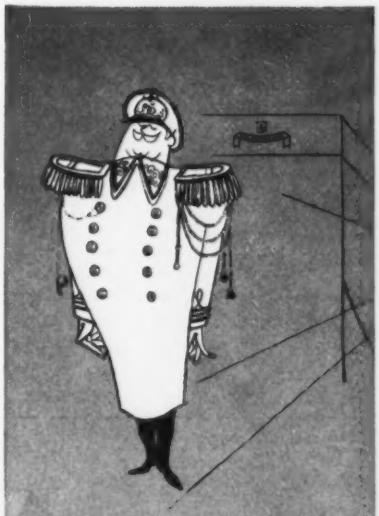
Technical portions of the Code are patterned closely after the American Concrete Institute recommended code, with appropriate references to American Society for Testing Materials specifications. All allowable stresses and design considerations are from ACI.

Because of the special conditions existing in New York City on design of large structures, the Code requires that the project owner retain a licensed engineer – approved by the architect and the engineer – to inspect of all phases of concrete construction, including the placing of both the forms and the reinforcement.

The Code states that "The owner of a proposed concrete structure, where controlled and average concrete is being used, shall engage a licensed professional engineer to supervise the testing of the materials and the inspection of concrete construction, to check that all required tests are made and laboratory tests are submitted, to order such changes of the mix of concrete as required to produce concrete of the necessary strength, and to report to the superintendent any deviation from the requirements of this article as indicated by records of inspection and reports of tests. The applicant for the building permit shall submit to the department a signed statement by the above mentioned licensed professional engineer, stating that he has assumed the responsibility for inspection of the concrete construction work and will file all reports as required by the department."

Eipel said reputable contractors like the idea of having a responsible engineer assigned to their jobs, and no owner complaints are expected. "It will be up to the engineer and the architect to explain to the owner the importance of project inspection," he added.

The Code further explains that "All controlled concrete work, in-



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Robert Sarason, *General Manager*

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cluding concrete forms and reinforcement, shall be continuously inspected at the mixing plant and at the work site by qualified inspectors, under the supervision of the licensed professional engineer, employed for this purpose by the owner. A record shall be kept of such inspection which shall cover the type, quality, and quantity of concrete materials, including water; the mixing and placing of the concrete; the slump and air content of the concrete; the placing of the reinforcing steel; the size and dimensions of the concrete members, for compliance with the specifications and approved plans; and a complete record of all test samples and tests. The inspection record shall also include a complete record of the progress of the work and of the temperatures, including those of the concrete when placed, and of the protection given to the concrete while curing."

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There were several factors making a complete re-write of the code necessary:

¶ Technical advances of the past 25 years.

¶ The need for a revised format that would sectionalize material, for example, separating concrete from plumbing.

¶ Changes in terminology and abbreviations which are now universally recognized.

¶ Developments in the field, such as the use of high strength reinforcing bars, prestressing, and ultimate strength design.

¶ The need to convert the code into a readily useable document that could be interpreted easily.

With the exception of the section on Precast and Prestressed Concrete Construction, the new Concrete Code now is up for final review by city officials. The remaining section is nearing completion. Work on the Code was begun under the late Joseph DiStasio, of DiStasio and Van Buren.

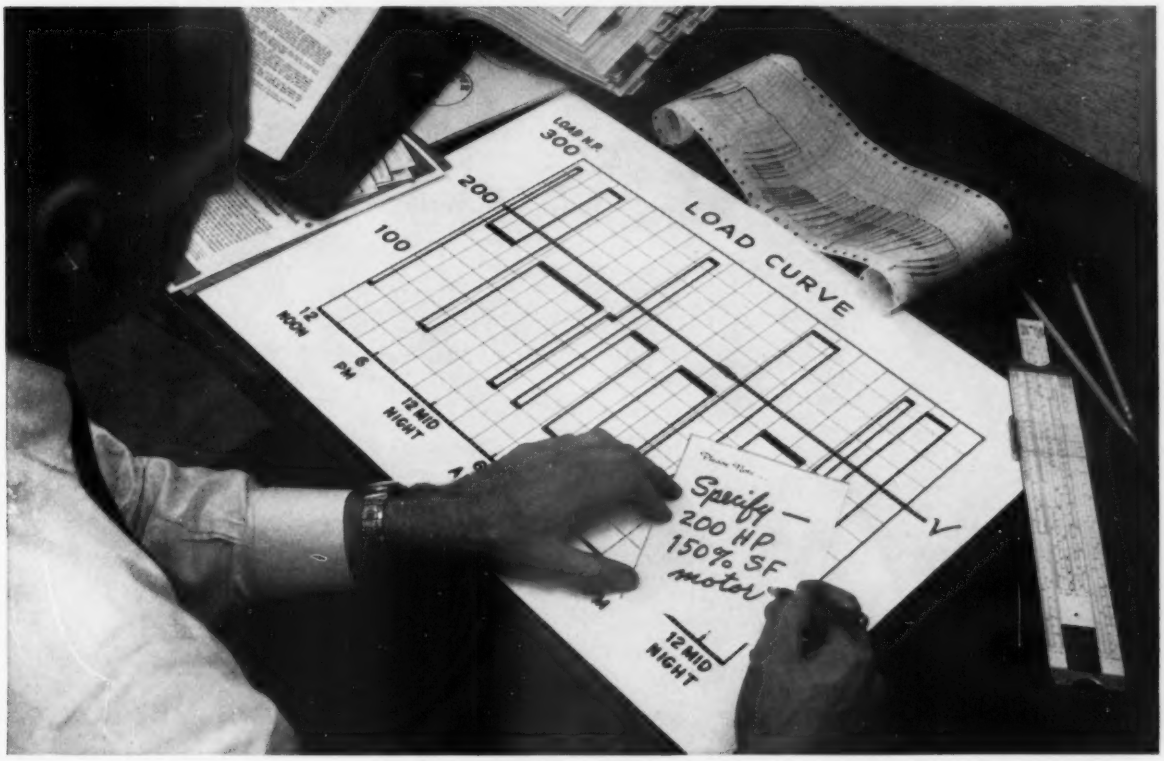
Formation of CIB

The concrete industry in New York did not always have such friendly relations with the City. About 10 years ago, after a series of failures, the City considered restricting the use of concrete for the structural frames of multistory buildings. "A lack of uniformity in the quality of concrete obtained on past projects" was given as the reason for the proposed restriction.

Everyone concerned with the design or construction of concrete became alarmed at the possibility of municipal restrictions, and organized to do something about it. The resulting organization, the Concrete Industry Board, is one of the most successful of its type in the nation. Organizations of engineers, architects, contractors, manufacturers, suppliers, and subcontractors were invited to send official representatives to serve on the CIB board. Then, to insure that CIB would never be controlled by a clique partial to one area of

SILICONE NEWS from Dow Corning

Over-motoring Out-moded



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Specifying motors with nameplate horsepower rated for peak load conditions is rapidly being out-moded as too expensive.

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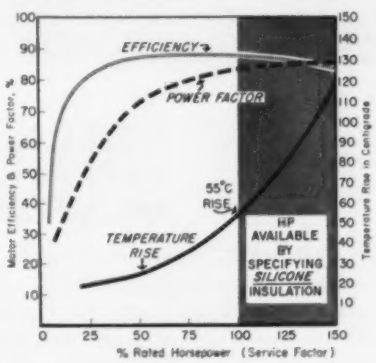
Additional savings in several ways: additional nameplate horsepower is usually more expensive than the extra service factor silicone insulation provides; additional horsepower requires extra floor space and heavier mountings; over-motoring power factor problems are eliminated or minimized.



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the trade, board members have been appointed by their respective organizations – not elected at CIB meetings. Eipel has been the board member from the New York Association of Consulting Engineers for a number of years.

The organizational setup of CIB gives the contractor equal status with the architect, engineer, and other professionals. Admiral John J. Manning, CIB Managing Director, thinks that "such recognition must in itself develop an increased degree of responsibility on the part of the contractor, his subcontractors, and their personnel."

The spirit of cooperation now existing within the concrete industry in New York is demonstrated by some of the program topics. For instance, at one meeting last year, the subject was New York City's more impressive building failures, with a graphic description of the reason for each failure. Although many of the people at fault were in the audience, the meeting ended without bloodshed.

CIB Grievance Committee

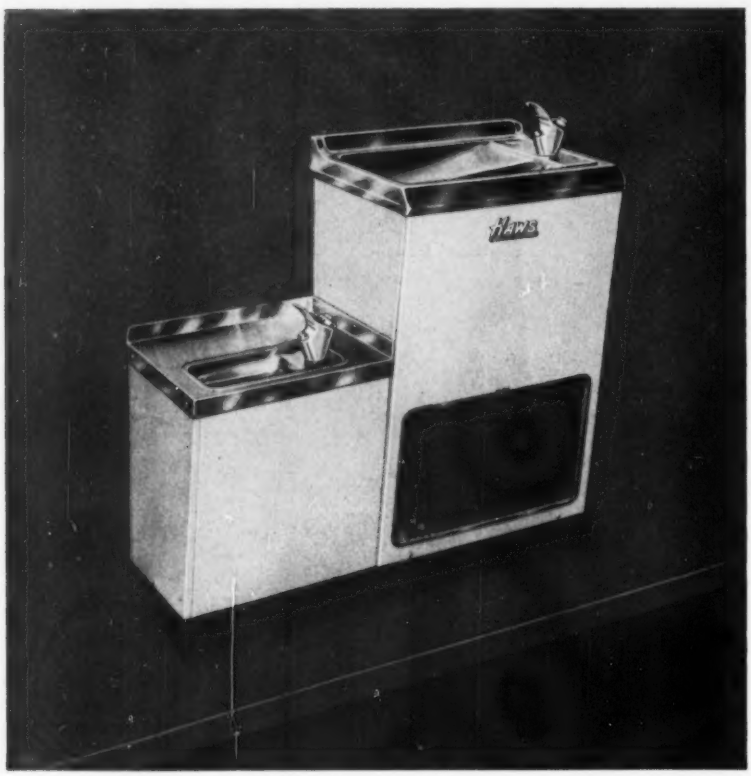
Since the entire industry was under fire at the time of the CIB formation, a grievance committee was formed so that contractors, subcontractors, engineers, architects, and other members could settle their disagreements internally. CIB believes that mistakes in concrete design or construction should be made known to those in similar work, in order to avoid repetition. But, Manning explained, a grievance committee was needed because "When difficulties arise in the construction of a concrete structure, it is practically impossible to place the responsibility where it belongs. The ready-mix man blames the testing laboratory; the laboratory blames the contractor; and the contractor blames the designer. There is a complete circle of blame, with no stopping point.

"It makes no difference to the owner of the structure which branch of the industry has fallen down. All he knows is that he has a concrete structure that is unsatisfactory and he condemns concrete in general."

Function of CIB

At the time CIB was formed, it was recognized that technical advances in the design and specification of concrete structures was being handled adequately by the American Concrete Institute and the American Society of Civil Engineers. The function of CIB was limited to seeing that designs were backed up by proper selection of ingredients and the exercise of due care in production, placing in forms, and curing.

"The time has clearly come when the very life of the concrete industry – at least in New York City – depended upon complete coordination and cooperation of all within the industry," Admiral Manning explained. ▲▲



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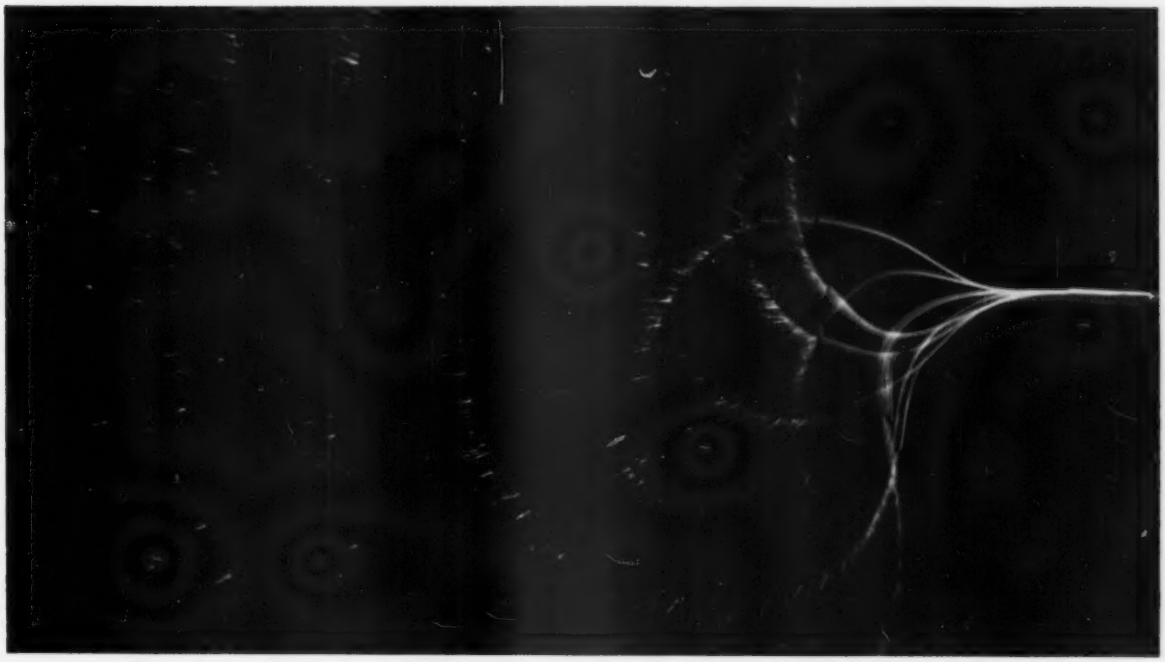

Exclusive Flutter-Jet washing thoroughly sweeps away collected dirt —prevents breakdowns, reduces maintenance, increases efficiency!

In the past, cleaning an air cleaner has been an expensive and inefficient process. Now, Honeywell has solved the problem of breakdown, high maintenance and poor efficiency with an exclusive Flutter-Jet washing system. The Flutter-Jet, a flexible rubber nozzle, sweeps the air cleaner with a powerful stream of water. Attached to a moving manifold, the Flutter-Jet assures complete cleaning—including all corners.

Fogging eliminated—Tests run by Honeywell engineers prove the Flutter-Jet nozzle keeps water in larger droplets as it strikes the surface to be cleaned, thus assuring greater washing action. Others, with cone shaped nozzles, tend to fog the water and reduce washing efficiency.

Less pressure required—The Honeywell Electronic Air Cleaner with Flutter-Jet washing, requires as little as 10 pounds of water pressure. Others with spray-type washing need 30 pounds.

Cannot be clogged by accumulations of salts and impurities in the water supply which frequently obstruct other types of nozzles. This means less maintenance, more trouble-free operation.

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Pays for itself—A Honeywell Air Recovery System, consisting of an electronic air cleaner and one or more charcoal filter panels, is often the answer to air pollution problems. This system can pay for itself by reducing the need for additional air conditioning equipment and lowering operational costs during both heating *and* cooling seasons.

Whatever your fresh air problems, you'll find that a Honeywell Air Recovery System—coupled with exclusive Flutter-Jet washing—can be engineered to match your exact requirements. This revolutionary new innovation in air cleaning assures you of air that's fresher than that obtained outside.

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Pleasure Boats
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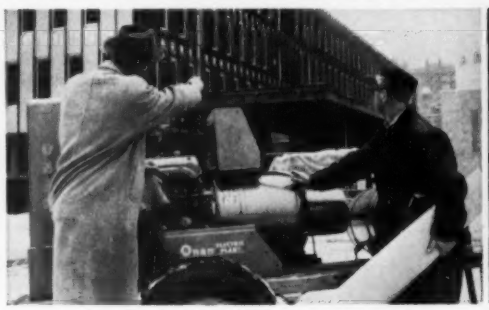
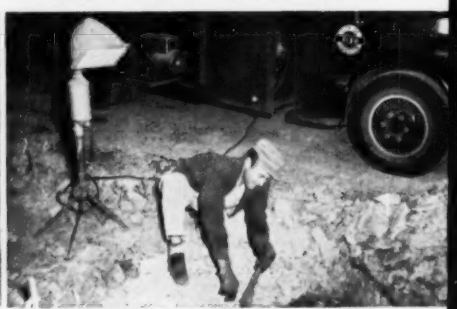
Auxiliary power for lights, communications, appliances on Work and Pleasure Boats.

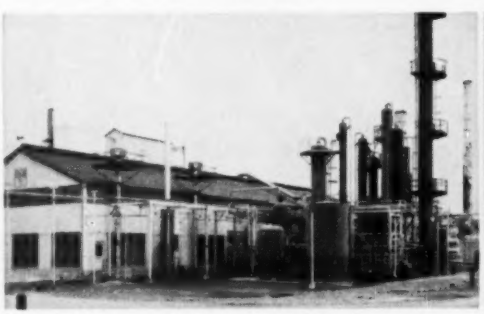
Portable power for pipeline X-Ray equipment, lights, tools and communications.



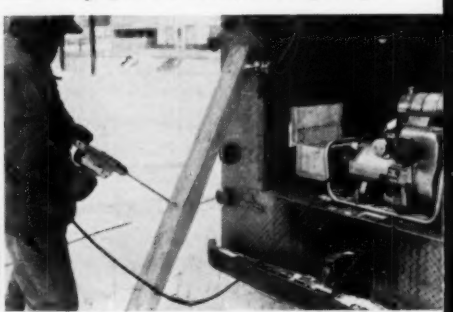
On-site power for construction tools, lighting in areas beyond mainline service.



Portable power for municipal maintenance equipment; tools, floodlighting.



Standby for critical processes in chemical, ceramic, and other manufacturing plants.



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In 1926, when Onan pioneered with the "Ten-Lite"—a 250-watt d.c. plant—there was a clear-cut need: enough power to burn ten electric lamps in hundreds of thousands of homes without electric utility service.

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Quite often, we never know who had the original idea for a new application. And, we're sure, Onan plants are used today in ways we've never heard about. If you have an idea for a new use, it may be helpful to you to see Onan plants at your local distributor. He's listed in the Yellow Pages in every major city. Or, write Onan for free literature.

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*You may submit as many ideas as you wish, but no more than one Onan plant will be awarded to an individual. There are no restrictions on form of entry . . . you may submit photographs, sketches or a written statement of any length you desire. Onan will judge all entries on the basis of originality, practicality and commercial utility, and decisions of the judges will be final. If the same suggestion or similar suggestions are made by more than one entrant, the first one submitted, according to the postmark, will be eligible for the prize. Winners will be notified on or before July 15, 1961. Entries must be mailed to "New Uses Contest," address below, and must be received not later than June 15, 1961. All ideas submitted become the property of Onan and, whether or not the entries receive an award, may be used commercially by Onan in any way it sees fit with or without acknowledgment of the originator. No entries can be returned.

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Syncretizer multiple serpentine heating elements deliver the required heating capacity with water quantities a third or less of those demanded by conventional elements; and the additional heating surface provided by Wind-o-line further reduces the water quantity. Smaller pipes and pumps are used.

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The High Spots

Florida Court Clears Consultant

A Federal jury, in the United States District Court for the Southern District of Florida, has decided that the Harrisburg, Pennsylvania, consulting firm of Gannett Fleming Corddry and Carpenter acted strictly in accordance with accepted engineering standards and practices in the design and supervision of construction of a municipal paving program for the city of Daytona Beach, Florida. The city had filed suit against the engineers, charging that the design and construction supervision were not handled properly. The jury was unanimous in its decision against the city.

Of perhaps even more interest than the vindication of the engineers is the amount of time taken to bring the suit to court. The paving program in question was finished in 1950. The city of Daytona Beach filed its suit in 1952. It was not until January of this year that the case finally reached the top of the docket.

Cornell's Common Curriculum

Starting this fall, the College of Engineering at Cornell University will enroll all first and second year students in a common engineering program. During these two years, the student will be able to take the courses basic to every branch of engineering, and have additional time in which to decide on his field of specialization. With Cornell's five-year engineering curriculum, this still leaves three years for specialized study. School officials say they believe this will give the student more time to make up his mind, and will give advisors a better chance to evaluate a student's work and potential.

Cornell extended its engineering course from four to five years in 1946. At that time, the extra year was intended to be used to broaden the basic studies program. More recently, with increasing emphasis on nontechnical subjects for engineering students, Cornell's extra year program has enabled them to keep up with these extra-professional topics without having to make drastic cuts in the number of technical courses. (See "Field Notes," page 64.)

Iowa Registration Law Upheld

For the first time, the Iowa state registration law has been tested in court – and upheld. Don Rhodes, superintendent of the Corning, Iowa, Municipal Light Plant, has been restrained by court order from the practice of engineering, because he is not registered in the state. The Iowa Engineering Society brought suit against Rhodes, charging he had practiced illegally in the design and construction supervision of an electric power substation. An Iowa District Judge ruled that the work performed

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should have been done by a registered engineer, and enjoined Rhodes from further practice.

Vermont Wants Tolls on Interstate

The Legislature of the State of Vermont has adopted a resolution urging Congress to permit states with populations of less than half a million to impose tolls on interstate highways. The tolls would be used to help cover the state's share of construction cost and maintenance. Under the Vermont proposal, the amount and duration of the tolls would be determined by Congress. The "half-million or less" plan would apply to five states: Vermont, Wyoming, Alaska, Nevada, and Delaware.

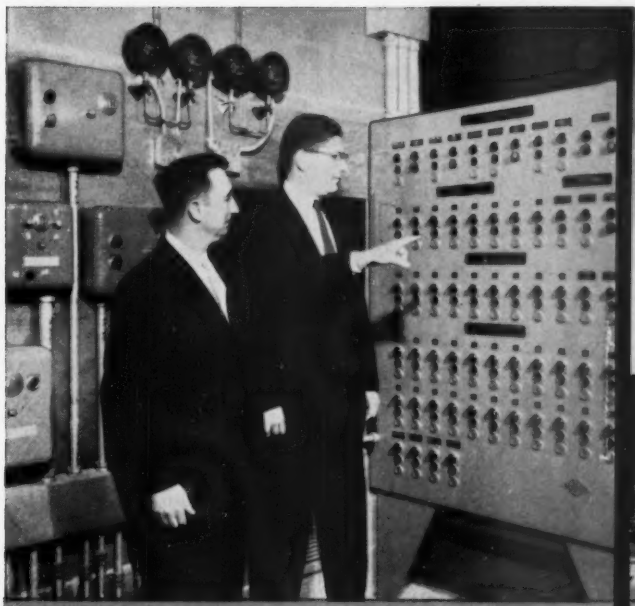
Opponents of the plan have pointed out that these smaller states are the ones that will have the least volume of traffic on their section of the interstate highways, and so would have difficulty collecting enough revenue in tolls to even pay for the maintenance of toll gates. The plan's backers claim that through traffic will increase sharply when the interstate program is completed.

California Wants Consultants Out

A bill has been formally introduced into the California Legislature, calling for repeal of the law which, after July 1st, will permit state college trustees to contract with private architects and engineers for the design of school buildings. Unless the Legislature acts directly on the bill, the college trustees will be able to name private firms, instead of taking all their work through the California State Division of Architecture.

San Diego, Too!

The City of San Diego has elected to do its own inspection and testing for a two-year construction program. In order to accomplish the work, the city has announced the hiring of 52 engineers, with the promise of permanent employment. Several consulting firms have com-



Centralized control for all of the 59 heating and cooling units throughout the building is provided by this Arrow-Hart Master Push Button Panel. Consulting engineers Arthur Bigelson and S. M. Shefferman look it over.

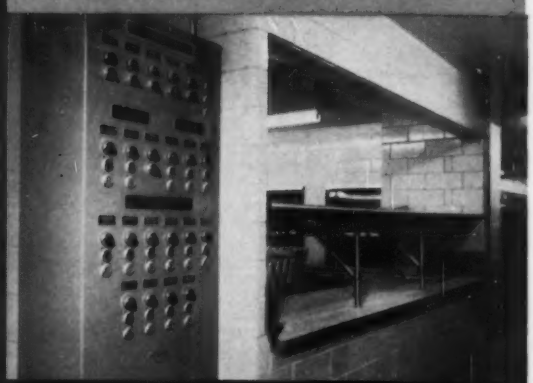
BENDER BUILDING, Washington, D. C. Builder: Blake Construction Co. Consulting Engineers: Shefferman and Bigelson. Mechanical Contractor: Frank Blanch, Sr. Electrical Contractor: Walter Truland Co., Inc.

SERVICE and QUALITY determine selection of ARROW-HART Motor Controls for Bender Building

ARROW-HART MOTOR CONTROLS used in the ultra-modern Bender Building, largest new office building in Washington, D. C. include across-the-line, reduced voltage starters, and push button controls for the heating, ventilating and air-conditioning motors. Centralized master panels operate all magnetic starters and controls for restaurant equipment and other special facilities.

ARROW-HART FIELD ENGINEERING SERVICE played an important part in assuring prompt, trouble-free installation of hundreds of individual motor control units by the electrical contractor. Working in close cooperation with the mechanical contractor, the temperature control supplier and the consulting engineers, Arrow-Hart's Field Representative coordinated all ordering information. The centralized control panels were pre-engineered for specific installation requirements.

Write for more information on Arrow-Hart Motor Controls and Service to The Arrow-Hart & Hegeman Electric Company, Dept. CE, 103 Hawthorn St., Hartford 6, Connecticut.



All restaurant electrical equipment, including fans, compressors, pumps, etc., is controlled by this master push button panel custom-engineered by Arrow-Hart.

CONSULTING ENGINEER:
S. M. Shefferman of Shefferman and Bigelson . . . "Arrow-Hart met the rigid specifications that we demanded in the construction of this building."

MECHANICAL CONTRACTOR:
Frank Blanch, Sr. . . . "Arrow-Hart's Master Push Button Control Panel that provides centralized control should certainly save money in the operation of the 59 heating and air conditioning units."

BUILDING SUPERINTENDENT:
Robert McDaniel . . . "Arrow-Hart supplies good, durable equipment that does the job expected of it."

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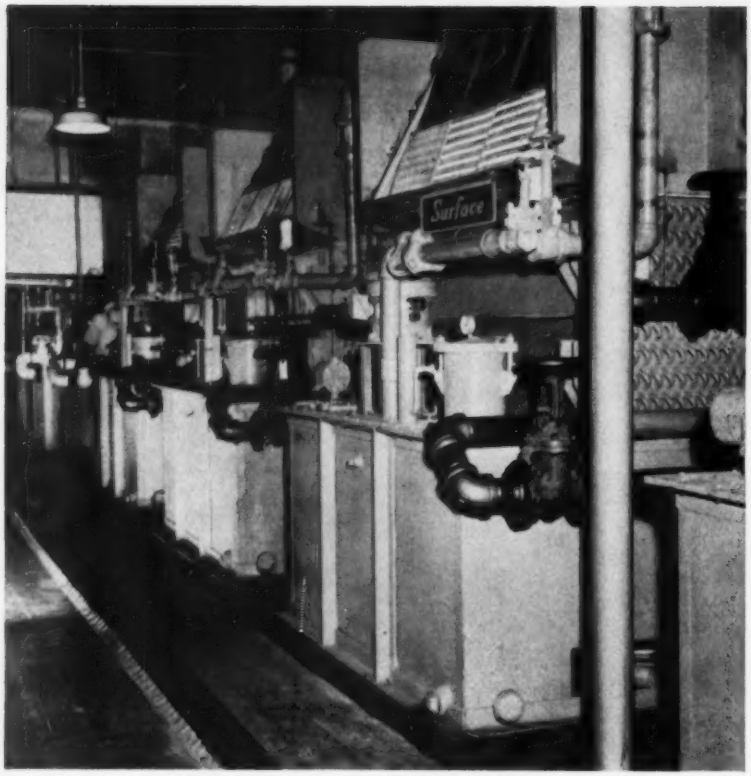

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plained that city officials have tried to pirate their key employees.

The San Diego branch of the Consulting Engineers Association of California appointed a delegation to meet with city officials to protest this hiring, and to point out the advantages of using consultants rather than maintaining a large staff. The delegation ran into an icy reception from the city engineering department, and was told it need not expect any further work from the city. The general impression in San Diego is that the city is engaged in what amounts to "empire building." Also, the reception accorded the local group points out the importance of concerted action by state and national associations.

Prestressed Concrete Gains

The Prestressed Concrete Institute has predicted that sales of their material in 1961 will increase 20 percent over the present annual figure of $300 million. PCI president J. O. Whitlock said the increase would come largely as a result of expanded government road and bridge programs, and also from research providing expanded use for prestressed concrete.

Man-Machine Communication

Douglas Rose, of MIT, told the Winter Meeting of the American Institute of Electrical Engineers that the increasing complexity of electronic computers is creating more serious problems in communication between man and machine. Rose said that man now must create other machines to help him communicate with computers, because the scope of "thinking machines" is too involved for man to master by ordinary methods.

He presented a paper describing an Automatic Programmed Tool System, developed at MIT for the automatic manufacture of machine tools. The APT system, according to Rose, is a beginning step in the establishment of working communications systems. ▲▲

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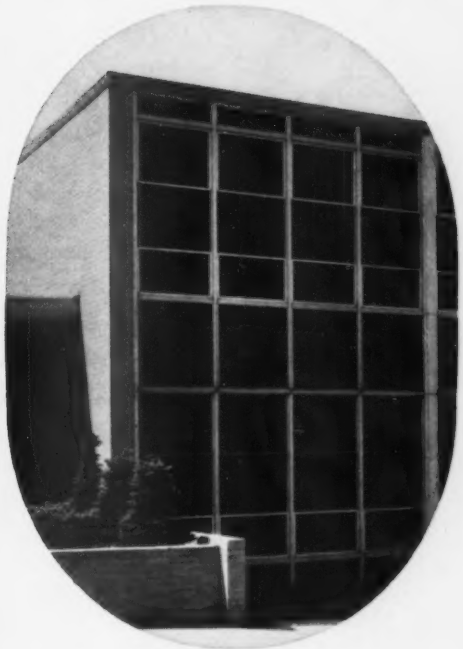

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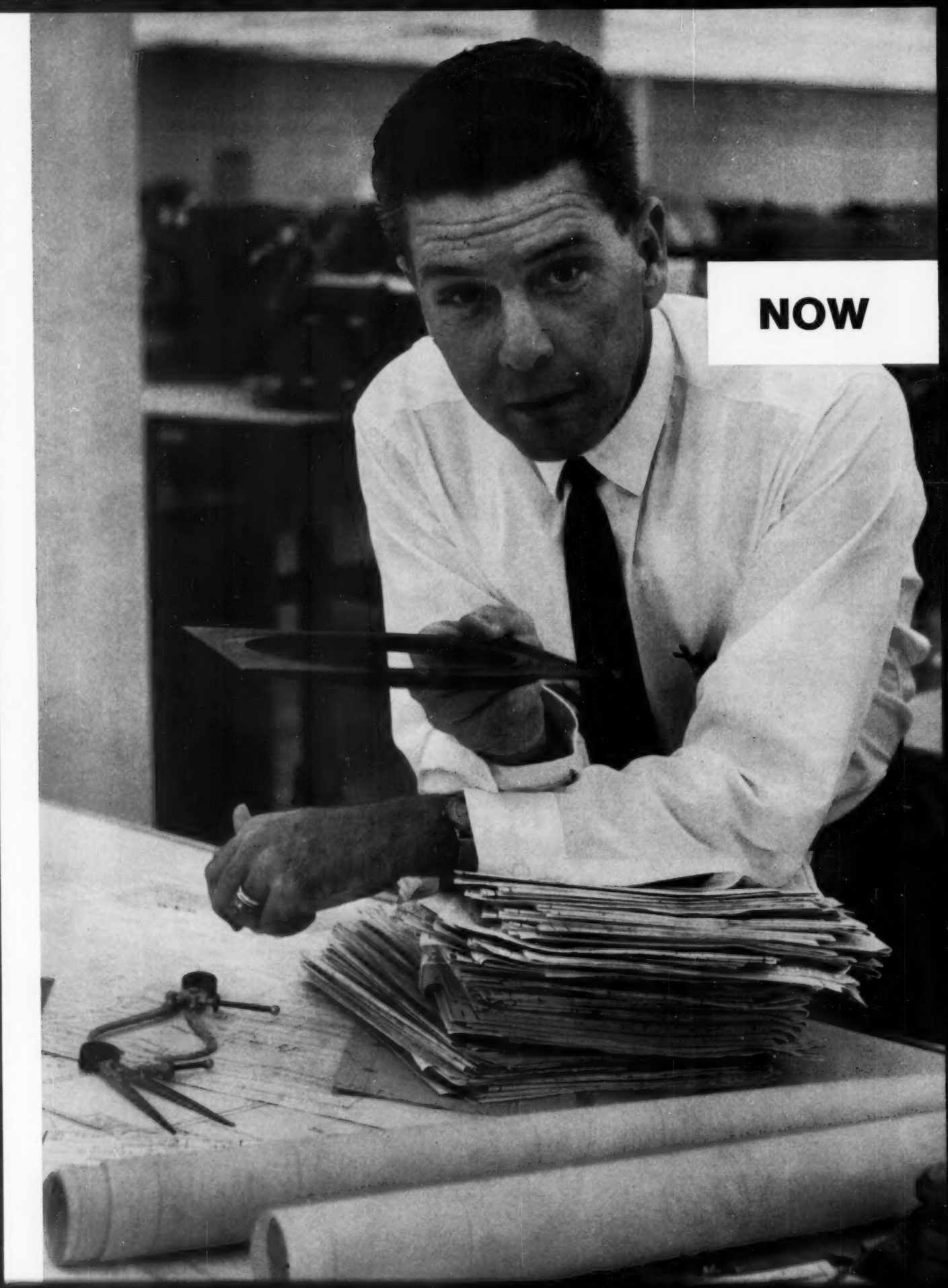
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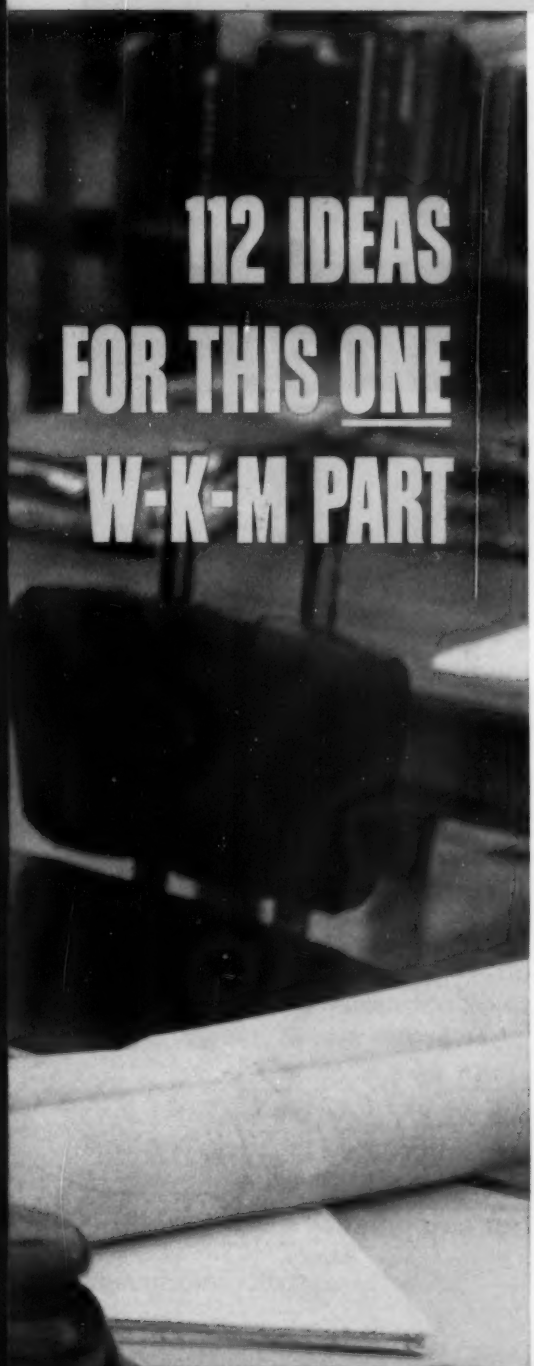

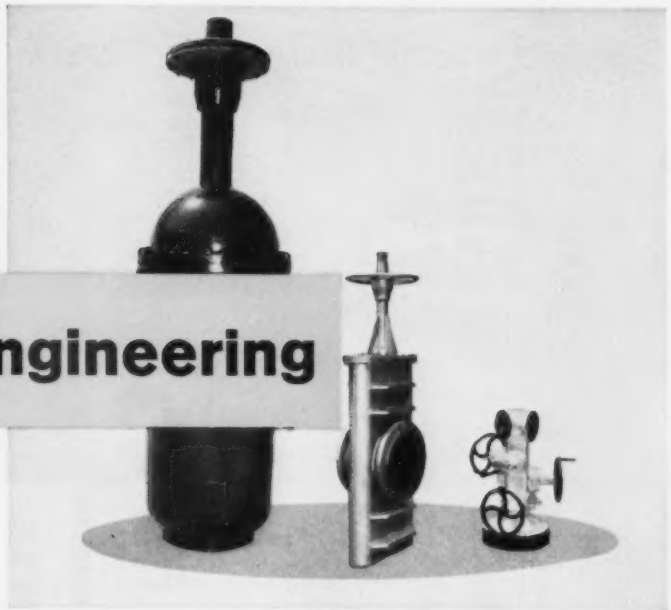

Left to right above, W-K-M's new: *Safe-T-Seal* Gate Valve (ASA); Pressure Sealing Gate Valve (ASA); Cross-type Triple Gate Valve (API).

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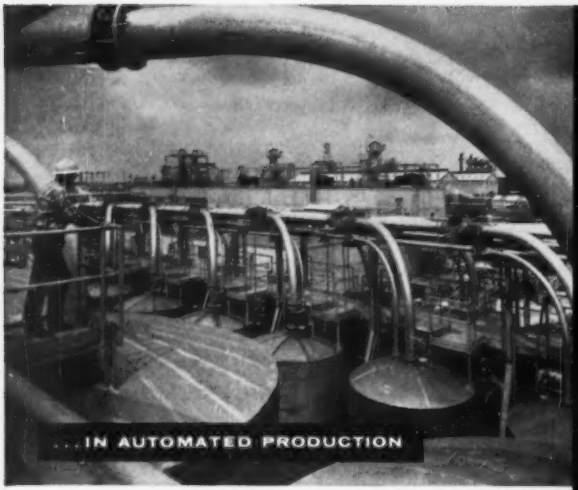
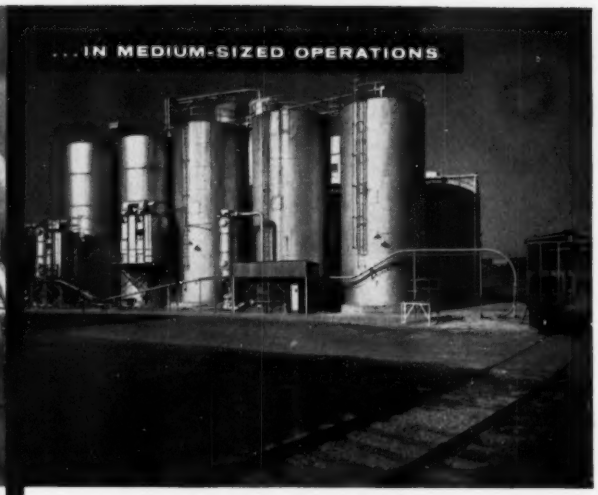


...IN AUTOMATED PRODUCTION

Airstream Conveyor Systems automatically handle polyethylene throughout all phases of production — drying, extruding, pelletizing, storage and bagging — at Phillips Chemical Co., Pasadena, Texas. High-volume, high-purity Dracco systems like this are used by most major plastics producers.



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Typical unloading-to-storage-to-process systems, like this one at St. Louis feed supplement plant of Merck & Co., enable bulk materials users to take best advantage of other modern production techniques and equipment. Such systems are easily expanded, with minimum engineering cost, when handling requirements increase.

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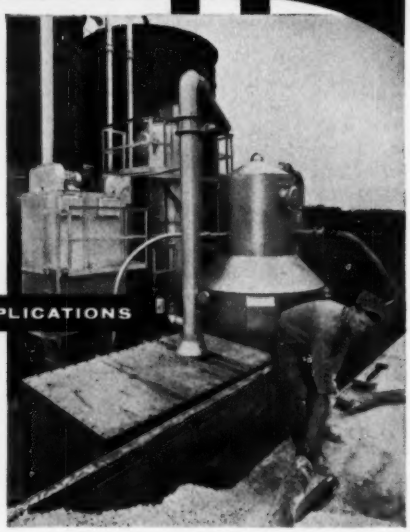

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Airstream Conveyors prove economical in handling quantities as small as one carload a month, or the equivalent. This low-cost, ground-level system at a mid-western processing plant is used only periodically to unload lime from trucks to storage, yet provides important savings in materials and labor costs.

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The Legal Aspect

DR. MELVIN NORD
Registered Engineer
Attorney at Law

Requiem for Registration?
Part II

AN APPEAL is pending in the recent Federal Court decision that declared Michigan and Ohio registrations laws unconstitutional *(Modern Engineering Service Co. v. General Electric Co.)*. While it is too early to predict the final outcome of the case, current events demand a thorough reappraisal of some of our registration laws.

The exact point at which the statutes were held defective was in the use of the word public, in connection with the definition of professional engineering. This word was held to be ambiguous, because it did not specify whether an engineer must be doing something which affects the public at large, in order to require registration, or whether he needs to be registered even if he is dealing only with an individual member of the public. This difficulty can be eliminated by redrafting these provisions and reenacting the statute in amended form (if the appeal fails). The definition of professional engineering then would not refer to the public at all. This is quite logical, since whether or not a person is engaged in the practice of engineering does not depend on who his client or employer is. Whether or not he should be exempted from the requirement of registration is an entirely different question from whether or not he is practicing engineering, and that should be treated elsewhere in the statute.

Removing the word public from the definition of engineering should not embarrass the engineer. Lawyers are regulated without any concern over whether they are dealing with individuals or the general public, and the same is true of hundreds of other professions, trades, occupations, and businesses.

Why It Happened

The exact point of failure of the statute, then, is not really a serious problem. And to consider only this aspect of the case is to overlook the really important facets of this decision. The question which should concern us most is not how we can cure the defect in the statute, but why the court felt it necessary to declare two statutes unconstitutional.

The court's opinion indicates that there are two reasons for taking such a strict view of the language of these statutes: they are criminal in nature; and the remedy sought is extremely harsh. Both of these factors are of basic significance, and they cannot be avoided merely by changing a few words. It probably comes as a jolt to engineers to learn that the

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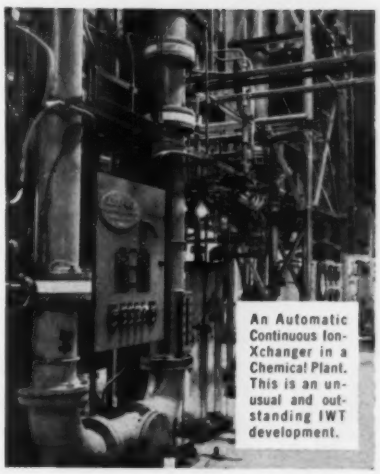
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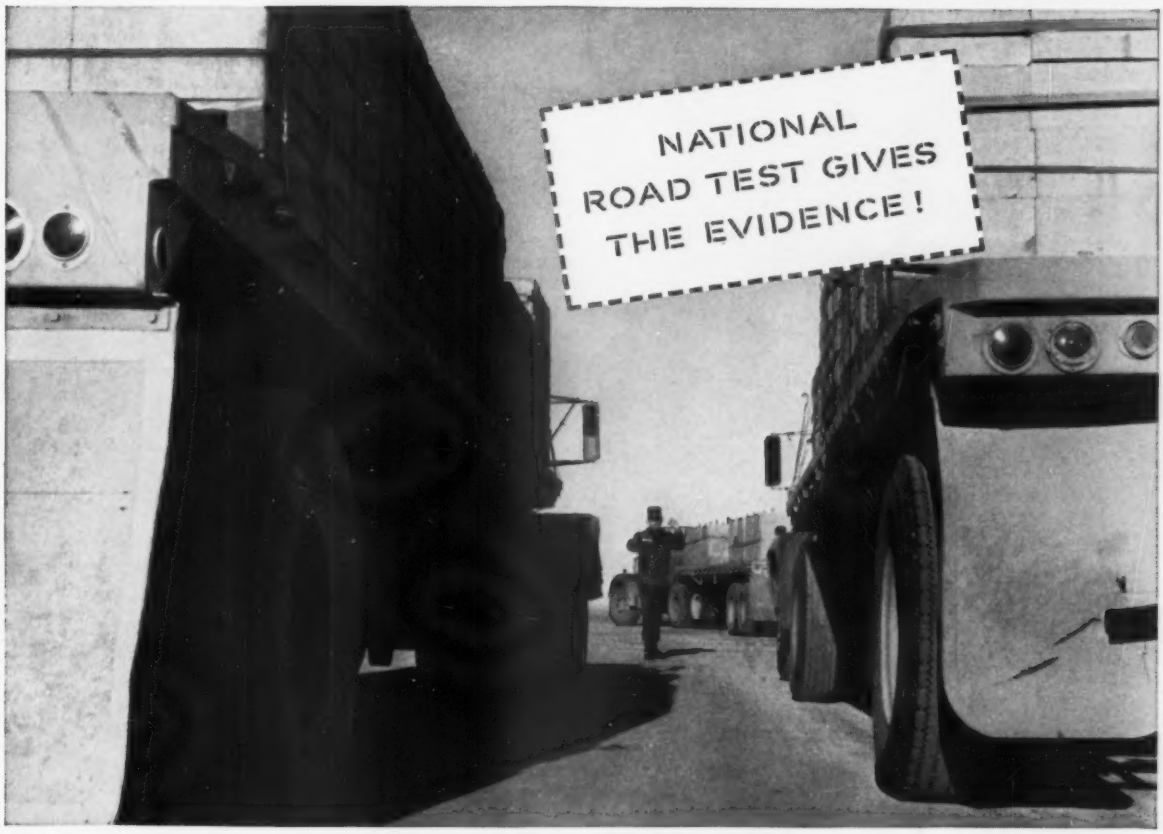
professional engineering statute is a criminal statute. The typical registration statute makes a violation a misdemeanor, punishable in Michigan, for example, by a fine of $100 to $500, or imprisonment up to 90 days, or both. Because of this provision, the court, in the case under discussion, said that the statute should be strictly construed, and on that basis found the word public to be vague and ambiguous.

It is a fundamental principle of criminal law that a criminal statute must not be so vague and indefinite that it will require a person to speculate unnecessarily whether or not his anticipated conduct will be criminal. Failure of a criminal statute to conform to this standard amounts to a violation of due process of law, and makes the statute unconstitutional. In the present case, no criminal prosecution was involved; it was a civil suit on a contract. Nevertheless, the court invoked this principle of criminal law to declare the statute unconstitutional — on the ground that whether the statute is constitutional does not depend on whether the case in which the question comes up happens to be a civil or a criminal case. Thus, it is obvious that the criminal nature of this statute is of prime importance in construing its meaning, although no one ever is subjected to a criminal prosecution under it. The more-or-less accidental fact that the statute is drafted in criminal terms caused an unexpected backfire in this particular case.

How the Law Operates

The doctrine that a statute is to be construed strictly against the state and in favor of the accused is a historical doctrine of criminal law. This doctrine existed originally because the penalties of the criminal law were extremely harsh — including, for example, death for any felony whatever. Under modern conditions, the extreme harsh-



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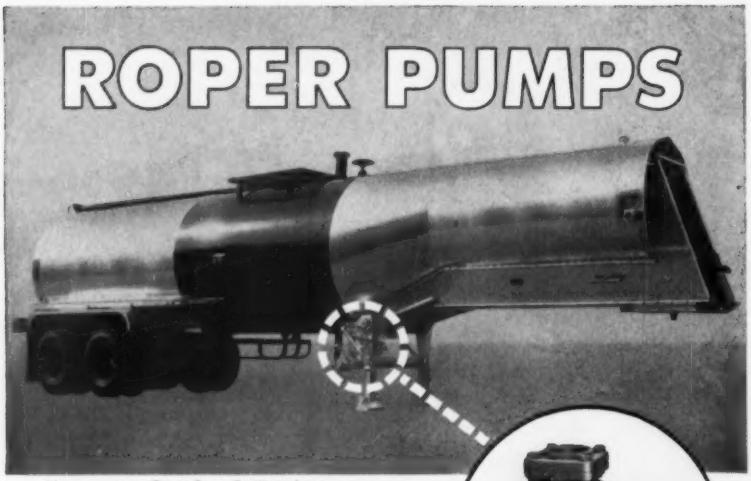

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ness of punishment in criminal cases has been eliminated, or at least greatly mitigated. Hence, in many states, the rule of strict construction of criminal statutes has been changed by law. In Michigan, for example, the law provides that the rule of strict construction of penal statutes should not apply to provisions of the Penal Code, and that such provision should be construed according to the "fair import of their terms," to promote justice and to effect the objects of the law. Whether this Michigan statute is applicable to the Michigan professional engineering registration ruling may perhaps be settled by the pending appeal.

Further, even though this was not a criminal prosecution, a harsh penalty was involved, i.e., the forfeiture of the right to collect very substantial sums of money. The court stressed this point, and it seems to furnish the real key to the decision, apart from any legal rationalization. The court simply was extremely reluctant to hold that a person should be deprived of the fruit of his labor or services on the mere technical ground that he was not registered, assuming it is not shown that the other party thought he was registered or that the failure to be registered caused any actual damage to the other party involved.

What Is Wrong

Thus, regardless of the ultimate outcome of this case, there are two important lessons that engineers should learn from it:

¶ The registration law is a criminal statute, and hence is unnecessarily subject to rules of criminal law which should have no place in an engineering law.

¶ The normal civil remedy which is applied in such cases (though not expressly provided by the statute) works a forfeiture of valuable rights, and is deservedly condemned as unnecessarily harsh.

Since this is so, the question arises, "Why should the registra-

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tion law be written to permit these undesirable side-effects?" The answer is that there is no reason for it. These results were not intentionally put into the engineering registration law, and they are not needed; they are merely hangovers from other laws of a similar type. Criminal prosecutions are virtually unheard of in connection with engineering registration laws. If that were the real basis for their effectiveness, it is evident that the various state registration laws would be substantially useless.

There is too much tendency at this stage of history to make everything criminal, whether it deserves such opprobrium or not. It may be that we have to put some vicious persons in jail, but there is no reason to talk about jail, criminal penalties, or harsh forfeitures, merely for failure to obtain a registration certificate. Let us reserve the name criminal for enemies of society, and not imply that anyone who slips up on some technicality is in the same class as a burglar, a murderer, or an arsonist.

What Should Be Done

What the registration law should provide is not a criminal penalty or a harsh forfeiture in the event that someone fails to obtain registration, but a means of making sure that no one practices engineering who is not registered or exempted. This is not in the present laws.

The registration laws should provide that an injunction could be obtained by a designated public officer in the event that anyone violates the registration law. This would effectively stop the violation. (A judge, incidentally, has the power to fine or imprison, in order to punish for contempt if the injunction order is violated.)

An even better approach would be to allow the registration board to issue a cease-and-desist order to violators (following a hearing before the board to establish violation of the statute). Such an order, if violated, would be punishable by a court upon request by the board. This is a fairly common procedure in administrative law.

The registration law also should provide expressly that there will be no forfeiture of contract rights merely on account of a first violation of the statute. Such forfeiture should occur only:

¶ If there was a misrepresentation as to the fact of registration, which the other party relied on.

¶ If the person or firm providing the engineering services is in fact incompetent and this causes damage to the other party.

¶ If the person or firm is ineligible for registration because of inability, or previous failure, to meet the statutory standards of competency.

¶ If the person was under a cease-and-desist order at the time of the subsequent violation.

A law of this type really would be effective and fair. Such a statute would receive from the courts the respect it would deserve. ▲▲

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HEV-E-OIL BURNERS start with a low fire, a small flame which gradually builds up to the required size for safe, smooth operation. Low fire and high fire are controlled exactly to assure top efficiency over the entire firing range. Moreover, Hev-E-Oil burners furnish all the primary and secondary air needed for efficient combustion. Available from 5 to 150 gph. Also combination gas/oil burners from 720,000 to 21,000,000 Btu.

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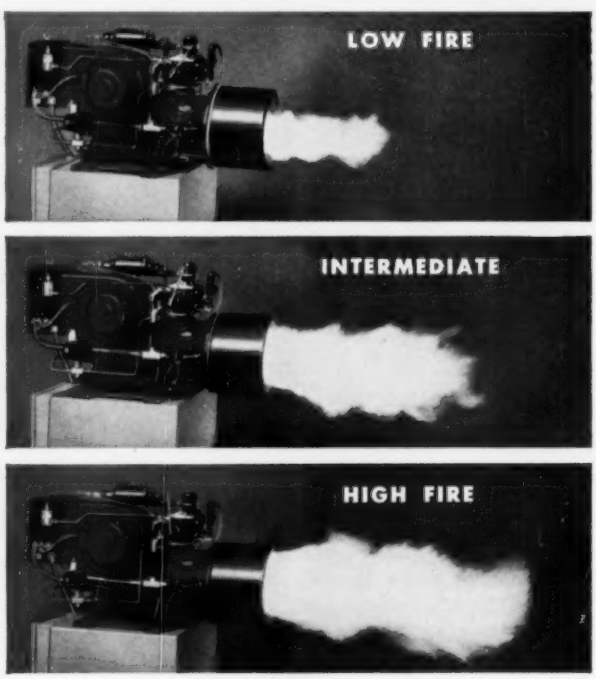

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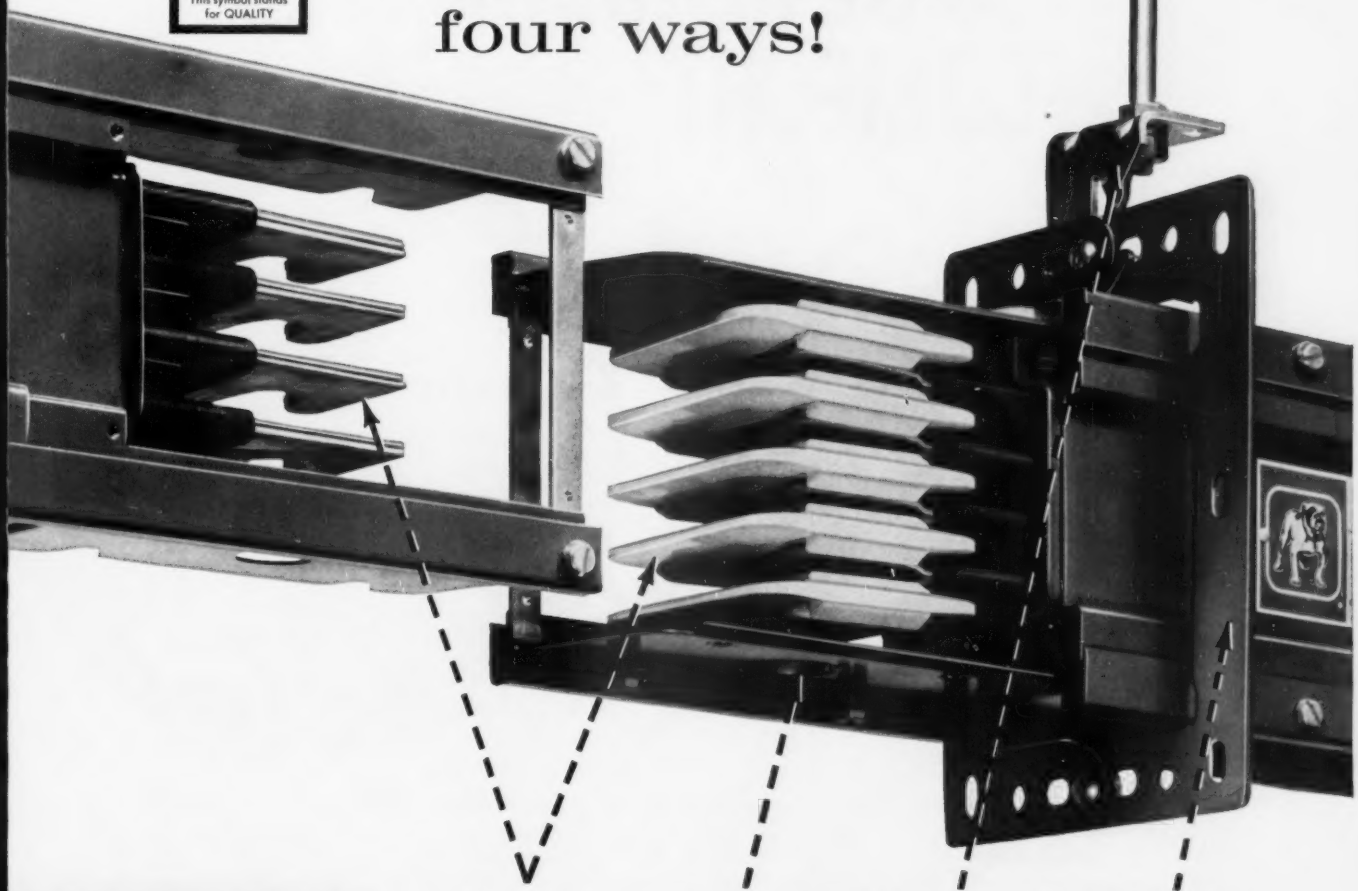
XL Bus Duct by BullDog

Makes light work of installation four ways!

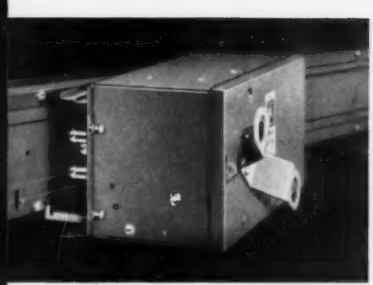


1 *Keyed ends of* plated aluminum bars align automatically, join as fast as sections can be handled.

2 *Single integral bolt* spins tight quickly to secure bars under a ton of pressure. Captive screws join casings together.

3 *New* HANGFAST *Adapter* bolts to suspension rod fast ...duct with standard hanger is instantly hooked and secured.

4 *Lightweight,* rigidly-made 10-foot sections require only *half* as many hangers as ordinary duct.



PLUG-IN SAFETY—Self-supporting XL Safety Plug hooks to duct, leaving workman's hands free to complete electrical plug-in with utmost ease and safety.

BullDog, the creator of plug-in bus duct, has for years assisted industrial plant operations by providing high performance, efficiency, flexibility and dependability in power distribution. Then BullDog went one step further . . . developed XL BUStribution® Duct to make installation and handling easier than ever before, as shown above. At the same time, BullDog incorporated foolproof dead-front safety as well as other features ensuring that workmen plug in for power the safe way *only!*

Ask your BullDog representative to show you all these XL Duct installation and safety advantages. He can also provide complete information about BullDog BD plug-in duct, LO-X® plug-in duct and LO-X feeder duct.

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Mich. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

I-T-E CIRCUIT BREAKER COMPANY

BULLDOG ELECTRIC PRODUCTS DIVISION

52 FLOORS OF PERSONALIZED COMFORT

Johnson Control a Highlight in New Union Carbide Building

One of the nation's most exciting and modern structures, the Union Carbide Building contains over 1.1 million square feet of rentable floor space. Its air conditioning equipment includes a high-velocity conduit system with 6,000 perimeter induction units and, for the interior, a high-pressure dual-duct system with 54 central fan systems.

Throughout this pace-setting skyscraper, a specially planned Johnson Pneumatic Control System maintains an ideal climate for business efficiency. Some 4,000 thermostats, 4,000 control valves, and related controls were installed to assure personalized, air conditioned comfort at all times!

Shown above is one of two Johnson Pneumatic Control Centers located in the basement and one of the top floor offices. Their features include: continuous indication of room temperatures, air and water temperatures, and pressures at over 450 control points; remote adjustment of all systems; optional recording of any point shown; and schematic diagrams of all systems and their controls, plus a push-button viewer with zoned floor plans of each floor in the building.

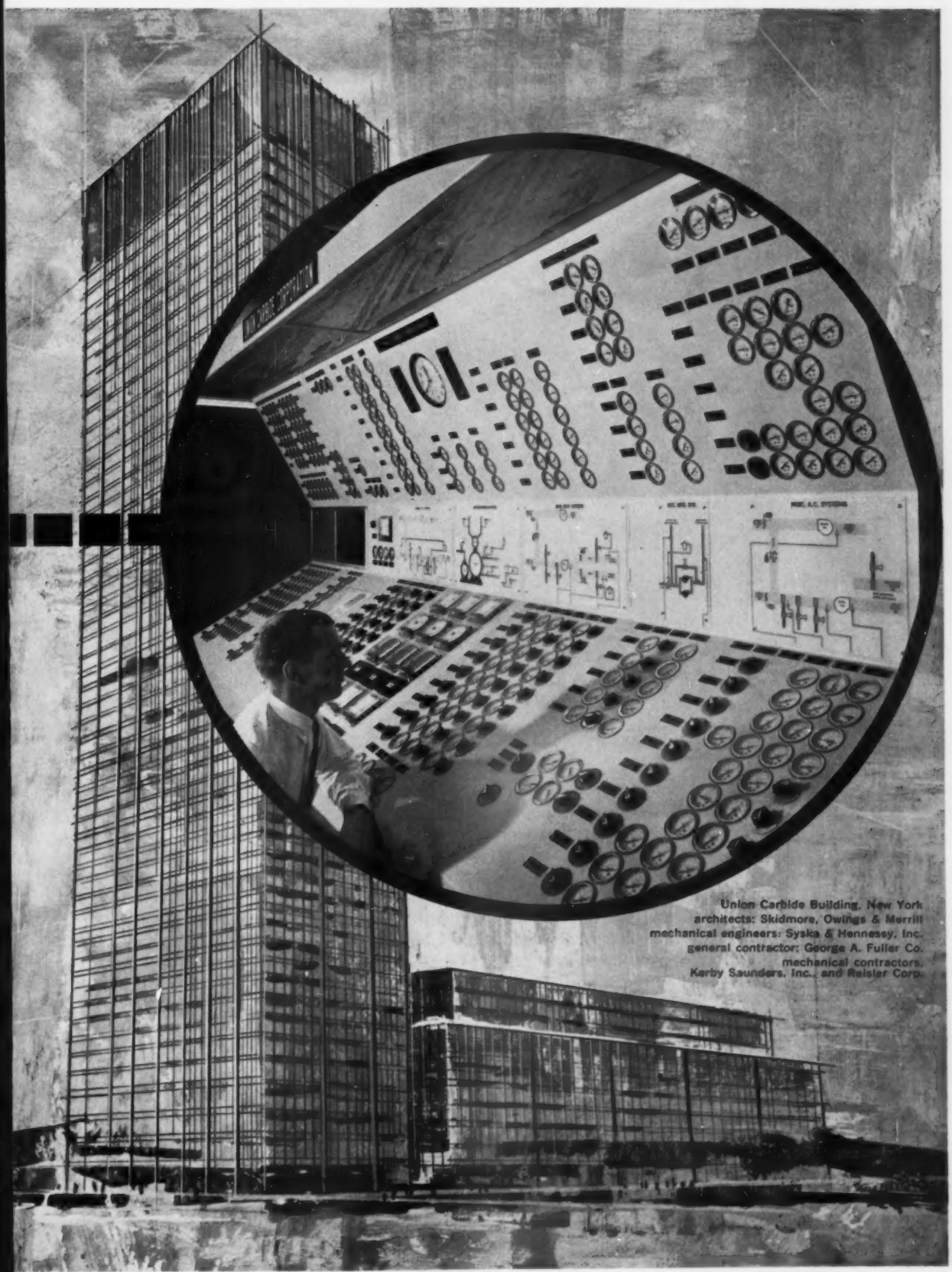
Engineered for economy as well as for comfort, the Johnson System makes possible major time and operational savings. With the aid of the control centers, for example, the number of man-hours required to supervise and control the vast network of primary air conditioning equipment is reduced to a minimum.

The specialized Johnson organization can help provide any building, small or large, with comparable efficiency and savings. Ask your Johnson representative to explain how the unmatched performance and lifetime economy features of Johnson Pneumatic Control can be applied to your clients' buildings. Johnson Service Company, Milwaukee 1, Wisconsin. 105 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885



Union Carbide Building, New York
architects: Skidmore, Owings & Merrill
mechanical engineers: Syska & Hennessy, Inc.
general contractor: George A. Fuller Co.
mechanical contractors:
Kerby Saunders, Inc., and Reisler Corp.

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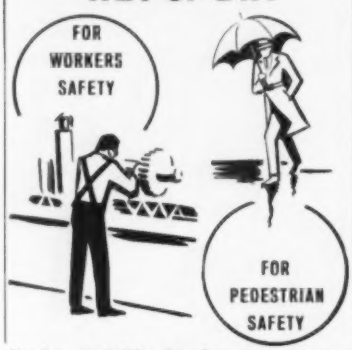

Exolon Anti-Slip abrasive grains are easily troweled into the surface of concrete to give it hardness and wear resistance. It never polishes smooth even in heaviest traffic. LOW COST. Anti-Slip is available in Aluminum Oxide or Silicon Carbide grains. The latter adds sparkle and glitter. Both bond with cement producing safe, non-slip surfaces.

EXOLON ANTI-SLIP abrasive grain may be bonded to wood, metal or concrete surfaces by first applying an epoxy resin, then sprinkling the abrasive on before the resin hardens.

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☐ Samples of EXOLON Anti-Slip
☐ Complete information and specifications.

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CCCELS Meeting Notes

RALPH S. TORGERSON, Western Editor

Field Notes

ACTIVITIES at the recent annual meeting of the California Council of Civil Engineers and Land Surveyors, in Santa Barbara, January 26th through 28th, reflected concern with several important issues facing the Council members. Speeches, panels, and discussions covered four major problems:

¶ Proposed legislation that would pack the registration board with political appointees.

¶ Threats by unions to force admission of professional employees.

¶ Trends among educators to replace engineering courses with liberal arts courses.

¶ Decreased prestige of the engineering profession as a whole.

On the bright side, there was the prospect of more work for consultants as a result of Federal measures to stimulate employment.

Legislation

Anthony J. Kennedy, the Council's legislative attorney, reviewed the two pending bills that are regarded as the most dangerous to the profession: the first would reduce the power of the Registration Board in California to matters of policy, and would place administration of the Board in the hands of political appointees; the second would change the disposition of license and registration fees, turning them over to the general fund of the state instead of keeping them for use of the Board.

The pros and cons of the pending legislation were explained in a panel discussion between retiring Council president Walter Hanna and Willard Shank, deputy attorney general for the State of California. Panel moderator was past president of the Council, Lee Scott.

The engineering profession seems continually to be on the defensive in legislative matters. Many delegates to the Council meeting suggested that the profession might better advocate positive legislation.

Labor

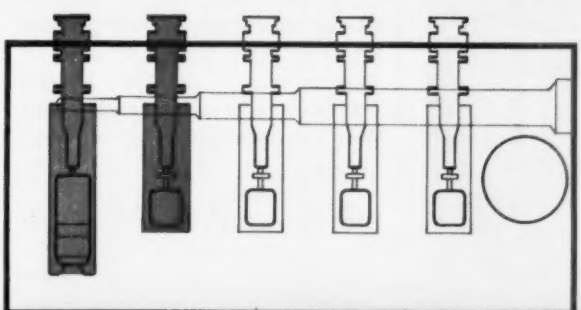
Thomas B. Flynn, manager of the Tri-Counties Employers Council, warned that engineers could expect a new drive by organized labor to unionize field engineers and surveyors. The AFL Operators' Union is presently most active in this field, trying to force union acceptance through secondary boycotts. Engineers were warned that all labor needs is one foothold in the professional ranks to constitute a serious threat to the profession.

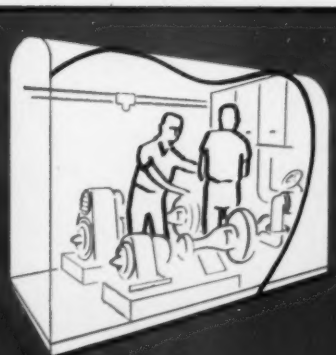
Learning

Dr. Robert Parden, Dean of the College of Engineering at Santa Clara University, expressed misgivings over certain trends in engineering education, particularly with regard to the effect they may have on smaller firms that do not have the time to train their employees in specialized fields.

Dean Parden pointed out that most engineering schools, in preparing students for the rapid changes in technology, have increased the basic mathematics and science content of engineering programs. Further, to add to the professional stature of the new graduate, there has been an increase in the social and humanistic aspects of the curricula, with the inclusion of such subjects as economics, history, political science, and communication theory. Additions to the

TEX QUAD PACKAGED PUMP STATION ...shaped for GROWTH!





The new, *rectangular shape* of the TEX-QUAD Packaged Pump Station is designed to meet the needs of a growing community. It permits a larger sewage pumping station to be installed with only TWO pumps *initially.* Then, as the area to be served increases, additional pumps can be quickly, easily and inexpensively installed to handle the increased load. There's ample space in the TEX-QUAD for as many as *five pumps,* providing added capacities up to *10,000 GPM!*

Operators find normal servicing and maintenance of the TEX-QUAD sewage pump stations easier, too. The unique, *rectangular* design creates a *more spacious interior.* This is one of the important reasons why TEX-VIT stations are today's *"best buy"* for any community.

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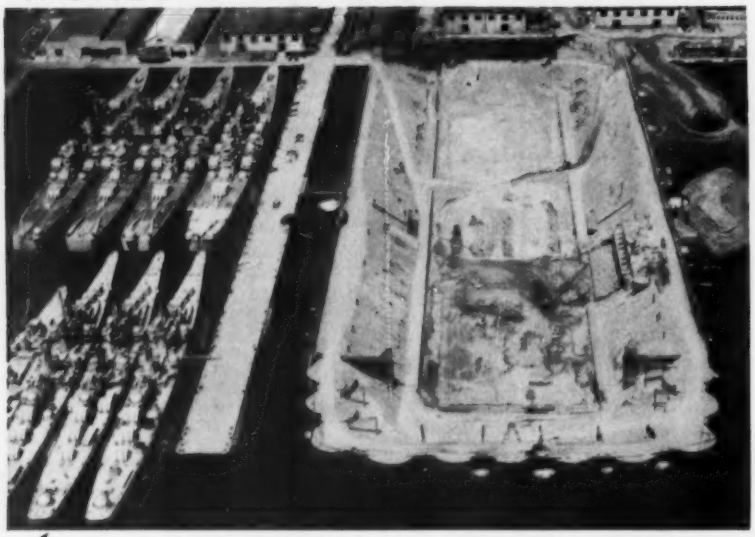
Write today for the new **TEX-QUAD CATALOG No. TQ-61.** It gives complete information on this new, rectangular **Packaged Pump Station.**

WORLD'S LARGEST DRYDOCK



U. S. NAVY DRYDOCK #6, *Bremerton, Wash.*
Arch. Eng.: Moran, Proctor, Mueser & Rutledge.
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curricula have required that some of the traditional courses be dropped to make room, and the section selected for removal by most schools has been training in the practice of engineering. This was chosen in the belief that most graduates could assimilate the material more effectively when they actually started work. In effect, the firm hiring the new graduate is given the responsibility of finishing his education.

Charles Bennet, of the Los Angeles consulting firm of Charles B. Bennet and Associates, referred to the cooperative engineering courses as a possible solution to the problem. Under the cooperative plan, as used at Marquette and several other engineering schools, students spend alternating months, or quarters, in the classroom and at work in industry, government, or private practice. Although this system ordinarily takes five years to complete four years' work, the student often is able to work his way through school, and graduates with valuable experience in the practice of engineering.

Another possibility being considered is an extension of engineering studies to the graduate level of medicine and law. A student would take a three or four year preengineering course before being admitted to an engineering school for technical study. A modification of this plan would provide graduate study in the practice of engineering, in addition to the present courses which are designed primarily for research and teaching.

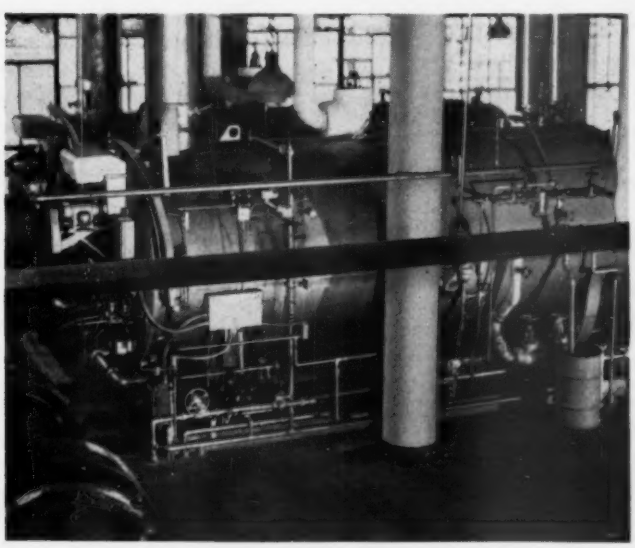
Limelight

The entire engineering profession is giving increasing attention to the public image created by engineers. Generally, there seems to be a decline in the prestige of engineering as a profession, and the California Council heard the results of a recent survey that bore out the general impression. Professor Edward McDonagh, head of the Division of Social Studies in the College of

can you afford to recommend a boiler designed 20 years ago?

BOILER ROOM CONVERTED TO WORK AREA

Robert A. Johnston Company, cookie, candy and chocolate products manufacturer in Milwaukee, Wisconsin, replaced four coal-fired boilers with two fully automatic, gas-fired CB boilers. Mr. James Vida, plant engineer, reports: "Compact Cleaver-Brooks design made it possible for us to install the boilers in another part of the plant — in an area of only 750 sq. ft. — releasing the old boiler room, 9000 sq. ft., for storage and work areas. It saved us the cost of an expansion project."



Today, with building costs twice what they were in 1945, your clients can't afford big boilers and the space to house them. They probably need greater boiler capacity, but they need extra space even more. The problem is to satisfy both needs.

To keep pace with climbing construction costs and the compact requirements of modern architecture, one manufacturer, Cleaver-Brooks, has proved that big boiler performance and capacity can be engineered into a small boiler package. Today's CB packaged boilers help solve many unusual installation problems. Low headroom is one example. Shortage of ground-level space is another; clean-cut, compact design cuts the space used, releases it for production or storage purposes. In some cases, "penthouse" installations have utilized space on an upper floor and *completely eliminated* the use of ground-level space.

Here are some of the features that combine for maximum space saving: four-pass design, forced-draft combustion, updraft construction and all the advantages of five square feet of heat-transfer surface per boiler horsepower. These standards of quality and compactness are only available from Cleaver-Brooks, manufacturers of the most compact, fuel-saving packaged unit on the market.

Cleaver-Brooks boilers are completely pre-engineered and tested as a package . . . expertly started by a trained field engineer. Sizes through 600 hp . . . oil, gas and combination oil-gas firing . . larger sizes in Cleaver-Brooks Springfield water-tube boilers.

See your local Cleaver-Brooks agent or write for a set of boiler-room templates designed for consulting engineers.

Cleaver Brooks®

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

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CUT MAINTENANCE COSTS

with this new design duct fan

Entire half of cone comes off . . . not just an access door . . . exclusive feature

While the DE BOTHEZAT® Bifurcator® **remains in the duct,** this new design duct fan provides an **easier, quicker** way to remove the fan wheel or motor . . . **speeds up** periodic inspections of fan wheel, bearings and extension shaft. The entire half of the cone unbolts and comes off, allowing plenty of room to work.

dependable . . . easy to install

Installation is as fast and simple as putting in a section of ductwork. DE BOTHEZAT direct drive motor, completely isolated from fumes and heat, insures steady, trouble-free operation over long periods. Ideal for handling corrosive fumes.

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Yes, I'm interested in cutting maintenance costs with DE BOTHEZAT Bifurcator Fans and the exclusive removable cone design. Please rush descriptive literature.

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Published ratings on DeBothezat Fans tell you exactly what the complete fan unit puts out. No guesswork — no allowance to be on safe side!

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Letters, Arts, and Sciences, at the University of Southern California, made an exhaustive survey of the situation, polling students, doctors, dentists, architects, business executives, ministers, teachers, and engineers themselves. The survey disclosed that, as a prestigious occupation, engineering ranks considerably below other professional fields. Not only did business executives and students rate the engineers low, even the architects, who might have been expected to understand engineering, listed engineers much lower than other professions. In fact, the engineers who were polled generally decided that doctors and a few others were to be rated higher than themselves. The only heartening response came from high school teachers, who rated engineers with doctors.

Looking Ahead

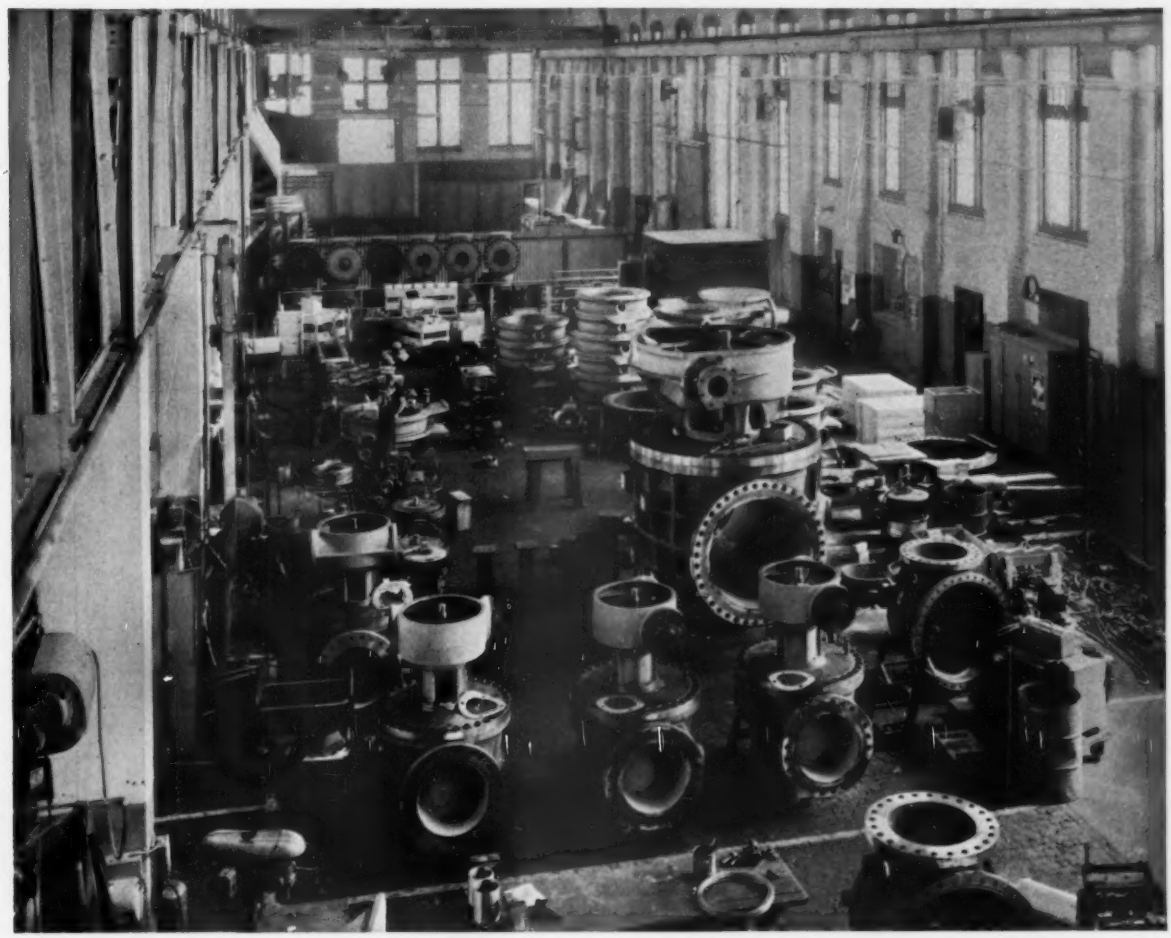
The bright note at the California Council meeting was the prospect of increased activity for engineers in urban renewal programs. In order to stimulate business and construction, as well as to clear substandard living areas, the Federal government is pushing urban renewal projects, and all of these will mean increased work for the civil engineer and surveyor. In all, there are 830 federal-sponsored projects under way in 49 states – only Idaho, Wyoming, and Utah are without Federal aid programs.

The Council

The California Council of Civil Engineers and Land Surveyors was organized in 1952, and has expanded rapidly, paralleling the explosive growth of the entire state. There are presently 14 chapters, with 390 members from 180 firms.

The California Council has no direct ties with any of the national groups, except through its members who may also belong to founder societies and other technical and professional associations. The only other similar organization in the country is in Massachusetts. ▲▲

ALLIS-CHALMERS



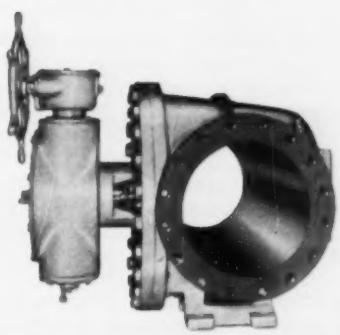
Another shipment of "habit-forming" valves

built for performance that always captures repeat customers!

Here we see one small part of the latest shipment of Allis-Chalmers valves destined for a long-time customer. These units will augment hundreds of A-C valves already installed in the same western metropolitan water system, many of them tracing satisfactory service back a quarter of a century!

Shown are four 300-lb, 24-in. *Rotovalve* units (two motor-operated, two manual) . . . a 48-in. cast-steel *Rotovalve* for 300 psi (motor-operated) . . . and several butterfly valves of the 136 ordered (all rubber-seated, motor-operated, ranging in size from 12 to 48 inches).

Allis-Chalmers offers today's only complete, perpetual rotary-valve stocking program, assuring you fastest delivery, thanks to "off-the-shelf" availability. For help anytime, contact your nearby A-C valve representative, district office, or simply write to **Allis-Chalmers,** *Hydraulic Division, York, Pa.* A-1395



The ROTOVALVE is probably your best all-round buy in a valve. Wide open it has no more resistance to flow than a straight piece of pipe of equivalent length. Actually seats itself tighter with use. *Rotovalve* is an Allis-Chalmers trademark.

The Readers' Guide

Highways – Here and Abroad
page 80

Highway history in the United States can be divided quite conveniently into two chapters, one for the 19th century and one for the 20th. Chapter one is essentially the story of the Federal government's long battle against involvement. Chapter two is the story of its capitulation and emerging influence.

For the consulting engineer, highway programs on the Federal level almost always have brought feast – followed soon by famine. But they always have retained a significant share of highway design work, if not in dollar value, then at least in project significance. For example, most of our popular toll roads were designed by engineers in private practice. U. S. consultants also have done extensive highway work abroad. But highway progress is hardly exclusive to the U. S. – as this month's staff report clearly shows.

New Concrete Code
page 39

"The New York City Building Department and the concrete industry have cooperated to produce a new concrete code." Eastern editor Marjorie Oden describes New York City's proposed new concrete code, which will be adopted soon.

Invalid Registration Laws?
page 55

"The question is . . . why the court felt it necessary to declare two statutes unconstitutional." Melvin Nord explains the court action which declared Michigan and Ohio registration laws invalid.

Engineering for Economy
page 76

"An important and often overlooked function of a true engineer is his ability to accept the challenge of projecting and applying . . . technical breakthroughs in the most economic manner." J. B. MacLean applies developments in electrical engineering to a study of the advances made by consultants in all fields.

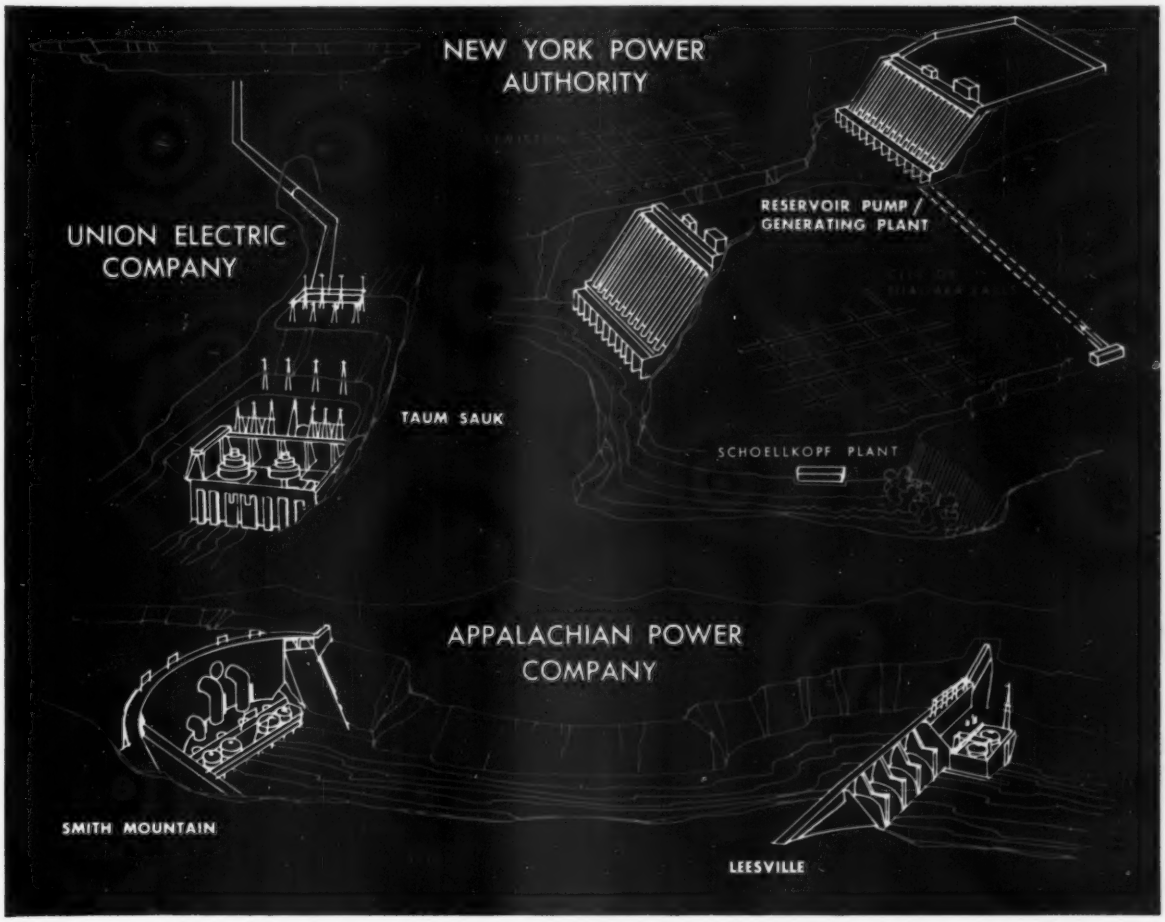
Stockholders or Partners?
page 109

"Many of the violent opponents of corporate practice are consultants with small organizations whose needs are adequately met by individual proprietorships or partnerships." CONSULTING ENGINEER previews the discussion of forms of practice from C. Maxwell Stanley's new book, *The Consulting Engineer.*

Effective Design Team
page 114

"In short, [consultants] have been sadly deficient in one important phase of development – professionalism." Harry J. Scharres points an accusing finger at engineers who refuse to accept their responsibilities as full members of the design team.

ALLIS-CHALMERS



Just what you'd expect from the pumped-storage pioneer:

first in all three

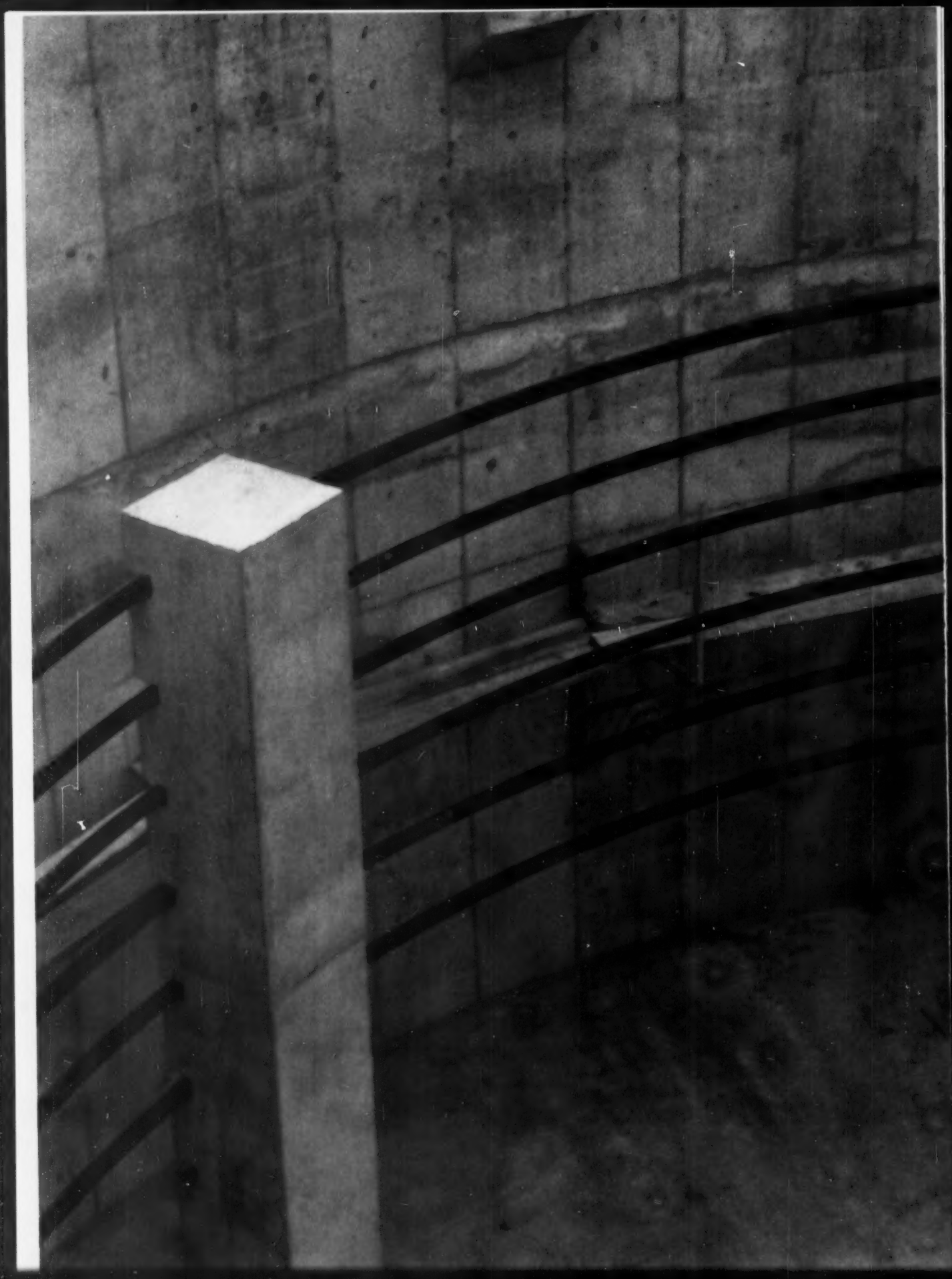
Pumped-storage power projects now under construction in this country all rely on Allis-Chalmers reversible pump-turbines. In fact, A-C is the only builder of complete reversible pump-turbine equipment!

First in boosting existing hydro at Niagara Reservoir pump/generating plant! This pumped-storage project will capitalize on the hydro-electric power potential of Niagara River without adversely affecting the scenic beauty of the Falls. Largest project of its kind, this installation will include 12 reversible pump-turbines with motor-generators . . . all designed and fabricated by Allis-Chalmers. As a turbine, each unit is rated 28,000 hp under 75-ft net head; as a pump, 3,400 cfs at 85-ft total head.

First in pure regeneration — at Taum Sauk! . . . also to have the largest-capacity hydro units ever built. Allis-Chalmers will supply two 175,000 kw reversible pump-turbines, each with a capability exceeding 300,000 hp under 800-ft head. (Pure regeneration installations need only a water supply to replace evaporative losses, so a creek is ample. Even a hill is unnecessary: the pool can be underground, in an abandoned mine shaft, for example.)

First in run-of-river — at Smith Mountain! This new project involves reservoirs at two successive levels, the lower dam forming a tailrace pool at the upper dam for two A-C reversible pump-turbines, each rated 87,000 hp at 180-ft head. Conventional hydro-generating units will also be installed — two higher-head units at the upper dam and two lower-head units at the lower dam.

For complete information on pumped-storage, hydro-generating equipment or other components for water control, contact your nearby A-C office. Or write to **Allis-Chalmers,** *Hydraulic Division, York, Pa.* A-1385



SPECIFIC WEIGHT COMPARISON AFTER 1 YEAR SERVICE IN STEAM CONDENSATE RETURN LINE

	specific pipe weight grams per lineal inch		change in specific pipe weight	
	Original Pipe	Corroded Pipe	Grams per Lin. Inch	Per Cent
Yoloy Pipe	40.3317	40.0786	—.2531	— .63%
Wrought Iron	41.3469	40.7438	—.6031	1.46%

Steam condensate pH, 6.65. Pipe samples, ¾ " nominal standard weight size.

Weight loss due to atmospheric corrosion after 3100 days exposure.

YOLOY STEEL	OPEN HEARTH	BESSEMER STEEL
3.70 LOSS	9.38 LOSS	18.29 LOSS

RESISTANCE TO SOIL CORROSION
13 Soils Ranging from 2.6 pH to 9.4 pH

	CARBON STEEL		YOLOY		WROUGHT IRON	
Time (Years)	Wt. Loss*	Penetration**	Wt. Loss*	Penetration**	Wt. Loss*	Penetration**
2	6.1	52	4.3	41	4.8	48
5.4	11.1	81	7.2	52	8.8	75
7.4	12.1	89	9.5	79	10.9	89
9.3	17.4	88	10.6	79	12.2	97
14.3	19.7	107	11.8	93	16.3	98

*Wt. Loss, oz/ft² **Penetration—mils (Average Max.)

SEA WATER IMMERSION TEST

Material	Days In Test	Wt. Loss (Grams)	Corr. Rate		Pitting—Mils	
			Mdd	IPY	Max.	Aug.
Mild Steel	2162	1439	36	.007	Perf.	128
Hand Puddled Wrought Iron	2384	1401	32	.006	Perf.	115
Mechanically Puddled Wrought Iron	2384	1247	28	.006	139	80
Yoloy	3429	1616	25	.005	90	62

SOLVED

tough corrosion problems by Yoloy Pipe at lower cost than wrought iron

Yoloy steel pipe resists corrosion better than wrought iron or carbon steel. It is rugged pipe, able to resist the corrosive bite of atmosphere, soil and chemicals. It has higher strength, more ductility, greater weldability. It is proven pipe, handling tough corrosion jobs for over 25 years.

Youngstown makes Yoloy from low carbon open hearth steel, alloyed with precise amounts of copper and nickel. Copper to resist corrosion better. Nickel to fight corrosion under both oxidizing and reducing conditions in the toughest applications.

Use Youngstown Yoloy steel pipe to solve corrosion problems above and below ground. In sewage disposal plants. Oil and chemical installations. For bridge railings. In steam condensate lines.

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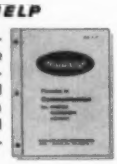

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Our Authors

James B. MacLean is Chief Electrical Engineer for Burns and Roe, Inc., and has been with the firm for almost 25 years. Before joining B & R, MacLean did electrical testing and design work for General Electric, J. G. White Engineering Corp., and the Central Railroad of New Jersey. He is currently in charge of electrical design of power stations and transmission lines; systems planning; and engineering and economic reports for electrical control systems. He is registered in 22 states, and is a Fellow of AIEE and a member of ASME. MacLean has an MA in mathematics from Wesleyan and an MS in electrical engineering from MIT. His article on the economics of engineering begins on page 76.

Harry J. Scharres is a graduate of the University of Illinois and has practiced in his native Chicago since 1948. He is a partner in the consulting firm of E. R. Gritschke & Associates. Scharres has done much of his work for institutions of higher learning, particularly Notre Dame, Cornell, and his alma mater. He was appointed by mayor Daley to the Chicago Architectural Landmarks Commission -- the only engineer on the Commission. Scharres has published articles which have gained notice in this country as well as in England and France. His primary concern at present is making engineers accept their professional rights and responsibilities. His article on the design team is on page 114.

This month's special staff report has many authors. As always, our readers made the most important contributions. But we also received interesting information from our correspondents abroad, from the French Embassy, and from such sources as the Pan American Union, Automotive Safety Foundation, American Association of State Highway Officials, Highway Research Board, Department of Commerce, American Road-Builders Association, California Division of Highways, New Jersey State Highway Department, Texas Transportation Institute, Asphalt Institute, and Portland Cement Association. To all of these groups, and the many others which are contributing to the progress of the world's highway systems, we extend our grateful acknowledgement. ▲▲

YARWAY news briefs

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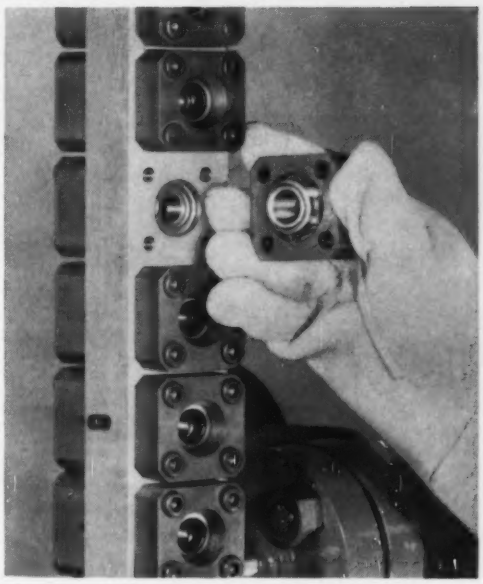
Write for Yarway Bulletin WG-1815.



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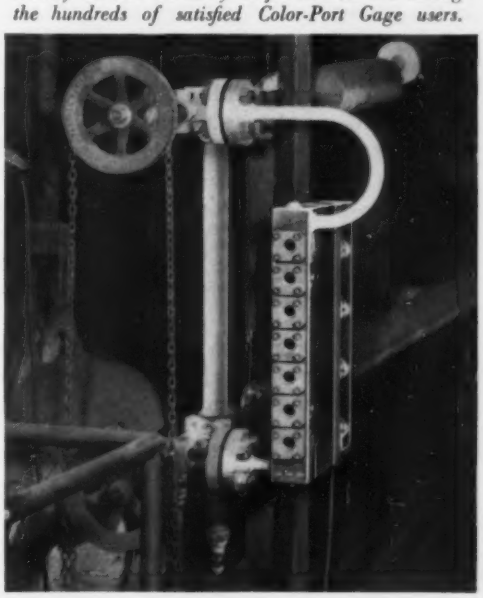
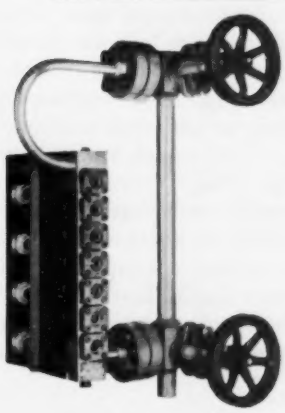
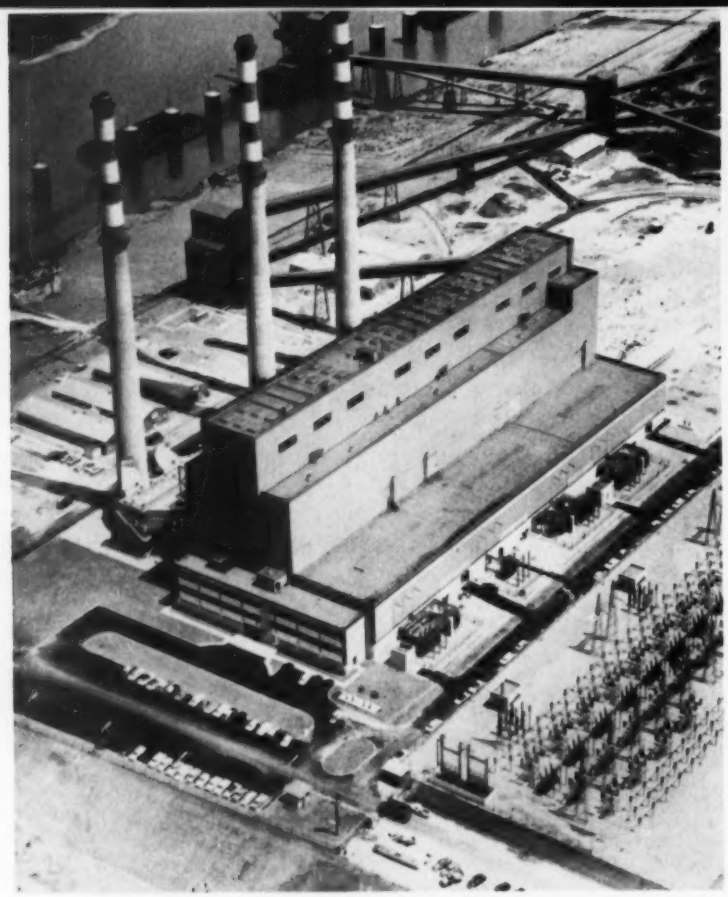


NEW COMPACT DESIGN WITH "WELBLOC" VALVES SAVES INSTALLATION SPACE



New "Welbloc" valves on Yarway Color-Port Gages reduce installation space requirements up to 40%. All working parts of valves are easily accessible. Improved direct flow from boiler drum to gage, reduces temperature differential.



Engineering for Economy

J. B. MAC LEAN
Burns and Roe

FOR TWO DECADES, our nation has been favored by remarkable progress in engineering. This progress can be measured by yardsticks as diverse as the prodigious production of war material, the sweeping improvements in manufacturing techniques developed in the postwar period, or the high number of Nobel prizes awarded to our citizens. However, if we deliberately exclude the romantic and the highly publicized role of engineering in such fields as nucleonics, missiles, and space projects, we find that public respect for the engineer is less than might be expected, considering his contributions to technological progress and the higher standards of living that have resulted from it. At that, scientists often are given credit for the work done by engineers.

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This lack of regard is particularly noticeable in the field of consulting engineering. The basic activity of consulting engineers is to make a fully satisfactory and economic selection of components and combine these components creatively into a project that will be successful and profitable. This is indeed a tremendous responsibility. Americans sometimes wonder why the opinions of European consulting engineers are more respected in the related fields of management and finance, even though the European engineer usually is considered to be stronger in pure theory and relatively weaker in practical application than his counterpart in the United States.

Perhaps the underlying cause of this difference in public attitudes stems from some vagueness in this country as to what the engineer's job really is. Under the stress of hot and cold wars, much technical work has been placed with architect-engineer firms and manufacturers, on the basis of applying existing data and know-how in a minimum of time. In this approach, the time factor overrides other normally more important considerations, such as reduced cost, better performance, higher return on the investment, and improved design created by the introduction of new ideas. With many important factors in engineering thus deliberately submerged or altogether neglected, it would be a mistake to consider such an approach typical of successful engineering.

The public generally understands that a first-rate engineer has some inventive ability and foresight. Most people also will agree that a competent engineer is one who successfully applies new discoveries and the fruits of research to everyday use. However, an important and often overlooked function of a

true engineer is his ability to accept the challenge of projecting and applying these technical breakthroughs in the most economic manner, which is not always achieved by an absolute minimum expenditure of labor and material.

In the creation of a steam turbine generator, for example, the design and methods used in the United States should differ significantly from those used in a country having higher costs for raw material and lower wage rates. Also, national standards of ruggedness, flexibility, and other desirable characteristics may vary greatly from country to country. The engineer's job, therefore, is not only to select and specify the design and methods that best meet essential technical standards, but also to strive for minimum expenditures on an installed basis. This requires consideration of all economic factors, including physical and functional obsolescence.

Economic Evaluation

The cost of engineering itself usually is only a small part of the total expenditure on a project. Money spent on engineering is a key investment, because, when the engineer selects the material and equipment to be used on the project, he assumes a critical function by controlling its actual cost and performance. In practice, the competent consultant reviews all facets of engineering, prior to fabrication and construction. These factors include initial costs, operation and maintenance, reliability, ruggedness, obsolescence, safety, flexibility, and future use. It is false economy to permit final decisions on these factors to be made by people whose skill and experience is substantially limited to the areas of capital cost and interest charges. The engineer is usually far better equipped to make accurate judgments than most financiers.

Slogans can be intriguing. "Minimum cost per kilowatt output" for generating stations has such appeal that at times it has become a convenient toy for would-be account jugglers and nameplate interpreters. Actually, this slogan is only sensitive to one facet of engineering – capital costs. Therefore, it is inadequate, and subject to inaccuracy, as an economic yardstick. The simple division of dollars by kilowatts is not what really counts. What we are interested in is the total economic worth resulting from a sizable expenditure. For instance, a critically needed and well-engineered generating station that permits the development of the economic wealth of a desert could produce greater profit than a station on a much more favorable site, even though the second station might have been built at one half the cost per kilowatt.

Advances in Design

Over the years, the increasing value of engineering has been maintained by the use of successful innovations. The engineer's astute evaluation of engineering concepts, technical details, and money required to arrive at the most economic development of a successful project is best illustrated by some generating station designs – of recent and older vintage:

¶ Before many of us could reach a light switch, power stations had duplicate busses, mainly because switching equipment, cables, and motors were not sufficiently reliable to assure the high standard of continuous service needed and demanded by the American power customer. With the advent of modern metal-clad switchgear, the reliability of switching equipment greatly increased. This resulted in the technical decision by engineering pioneers to recommend one service bus for each station. This bus usually is sectionalized so that its sections can be inspected, cleaned, and maintained at regular intervals with a minimum of difficulty.

¶ The use of progressively larger turbine generators not only reduced the relative amount of operating personnel required for a given output, but also gave higher station efficiencies – producing more power per unit of fuel. Larger and larger units, therefore, became engineering and economic musts. These larger units in turn required larger motors to drive the station service equipment. When voltages were held at the old figures, load currents began to climb with the increase in the size of the units. Heating and stress problems in electric circuits became more severe. As a result, consulting engineers exerted considerable pressure on manufacturers to produce reasonably priced, more reliable designs for higher-voltage switchgear and motors, and to raise the terminal voltage on large generators.

¶ Today, practically all of the main step-up transformers for generating stations are of the three-phase type. These transformers have the same superb reliability of single-phase units, and cost less on an installed basis. For example, the running of bus duct three-phase transformers requires no T-taps, fewer insulators, and a far simpler supporting structure. Consequently, this simpler design has resulted in increased reliability along with reduced cost.

¶ When there is a failure of electric cables which transport power from generators, large and expensive pieces of equipment are out of service until repairs are made. Generator cables are subjected to rigorous duty by excessive local ambient temperatures in summer, by cycling of their temperature with daily load changes, and by the very high mechanical stresses caused by short circuits. A generator outage is expensive. In fact, a typical outage of a large unit costs several thousand dollars per day, not including repair costs.

As a means of obviating the natural deterioration of cable insulation, cable joints, and other circuit components under this rigorous duty, American engi-

neers invented bus duct – essentially a copper bar conductor, supported on porcelain insulators and housed in metal casings. The cost of bus duct is approximately four times that of equivalent cable. This is an example of engineering for reliability, even though this reliability results in a more costly installation. Many of us remember the indignation and rejections we encountered when we first recommended the use of bus duct. Was bus duct uneconomical? If it was, it must be judged to have been poor engineering.

Consider a typical station with large generators, and compute the difference in installed cost between generator bus duct and generator cable. If we were to install generator cable and invest the savings, the interest would be compounded over the years. From this fund, we should deduct the total cost of the expensive shutdowns and bills for replacing cable, plus interest. Without a doubt, the more expensive bus duct is fully justified. Future evaluations of bus duct and cable will have to take into consideration the recent improvements made in modern generator cable, which is demonstrably superior to that made only a short decade ago.

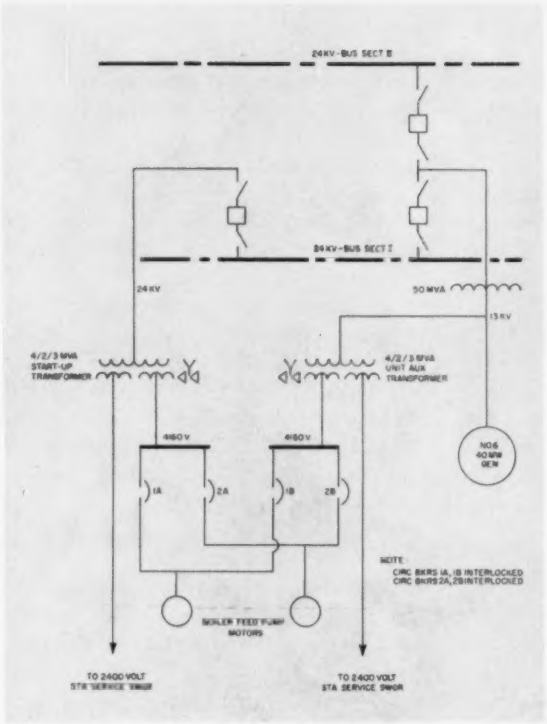
These examples are in the conventional field of generating station design. In the areas of electronics and nuclear power, as in any new field, potentially greater savings can accrue from the investment of engineering time and effort in economic and technical analysis of design details.

Arrangement of Components

Another important function of the consulting engineer is his knowledge of intricate equipment details. Using this knowledge, he can offer acceptable and economic innovations. For example, let us assume that the generator bus duct route has been carefully selected to provide the shortest run to the main transformer that is consistent with other factors in the economic design of the generating station. On the outside of the building, the generator bus duct goes directly to the low-voltage side of the main step-up transformer. It is usual practice to T-tap this bus duct to feed generator voltage to the high-voltage side of the main station service transformer.

Engineers began to wonder if something could be saved by running the circuits through the main transformer. There is a certain "bussing" which occurs inside the transformer as part of its design. This occurs at the top. A carefully detailed review with the designers of large transformers confirmed that, in a specific case, this internal run had all of the desired reliability. The only extra cost was for the second set of low-voltage bushings on the main transformer, to feed the auxiliary transformer.

This refinement is a relatively minor item in the engineering of a generating station, but the savings



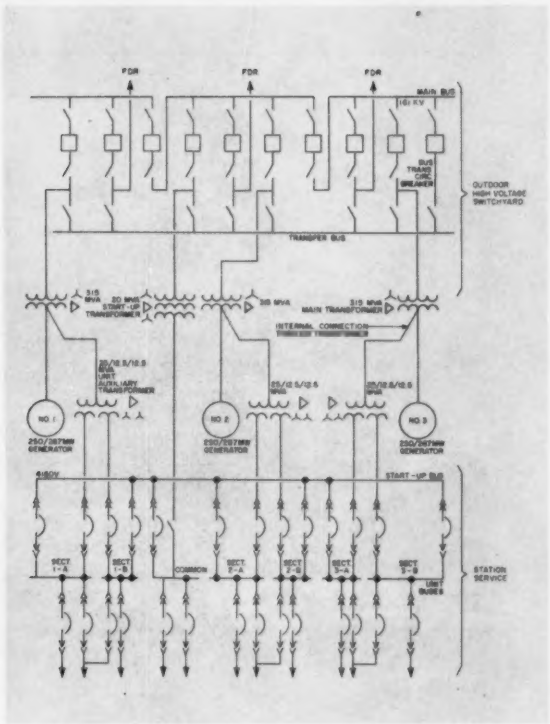
Use of three-winding transformers at the Mistersky Station.

can be significant. Our firm used this idea in the design of the Thos. H. Allen Electric Generating Station for the City of Memphis, Tennessee. The estimated savings for this three unit station totaled over $120,000. In addition, bus duct lengths were shortened, and there was a considerable reduction in the cost of the necessary supporting structures.

Service Voltages

Another significant example of where attention to details in excess of minimum engineering has proved to be rewarding is in the selection of station service voltages. Most of the large auxiliary equipment in a generating station is motor driven. In our recent extensions to the Mistersky Station of the Detroit Public Lighting Commission our studies indicated that 2400 volts was the most economical over-all choice for station service supply. Boiler feedwater pumps were the largest motor-driven auxiliaries.

Calculations showed that voltage drops which occurred on starting these motors were high enough to be an unacceptable nuisance and hindrance to good plant operation. Larger transformers could have overcome this trouble, but they would have increased costs and required more expensive switching equipment because of the resulting higher interrupting duties. An equally expensive alternative would have



Split voltage winding saved $130,000 per unit at Memphis.

been to make provisions in the design for putting the boiler feed pump motors on separate transformers fed at generator voltage.

However, a less costly solution that fulfilled the stipulations for reliability, acceptable voltage drop, and other operating requirements was accomplished by using three-winding transformers. The third winding of the main station transformers is used solely for supplying power to the motor-driven, full-capacity, boiler feed pump or its spare; 4160 volts was selected for this third winding so that standard switchgear could be used. Impedances of the three-winding transformers were selected so that the high starting currents had no objectionable affect on the 2400-volt station service circuits and lighting. This concept took time to develop and required a knowledge and review of transformer designs in order to establish a scheme that would be fully reliable. But it resulted in a saving of over $75,000 per unit, without curtailing reliability or flexibility in any way.

A similar example occurred in the new Memphis plant. We wanted to use a simple unit concept for the basic design, with one 25,000-kva main auxiliary transformer for each 250,000-kw generator. This arrangement gave lowest costs without compromising the engineering factors of ruggedness, flexibility, and simplicity of operation and maintenance.

Studies of station service voltages indicated 4160 volts to be the most economical when installed costs of motors, cable, switchgear, and load centers were considered. With this voltage, impedances within standard ranges could be specified, and the switchgear interrupting capacity easily could be held to a standard value of 250,000 kva. However, a 25,000-kva two-winding main station service transformer would then have to supply 3200 amperes at full load output on its 4160-volt side.

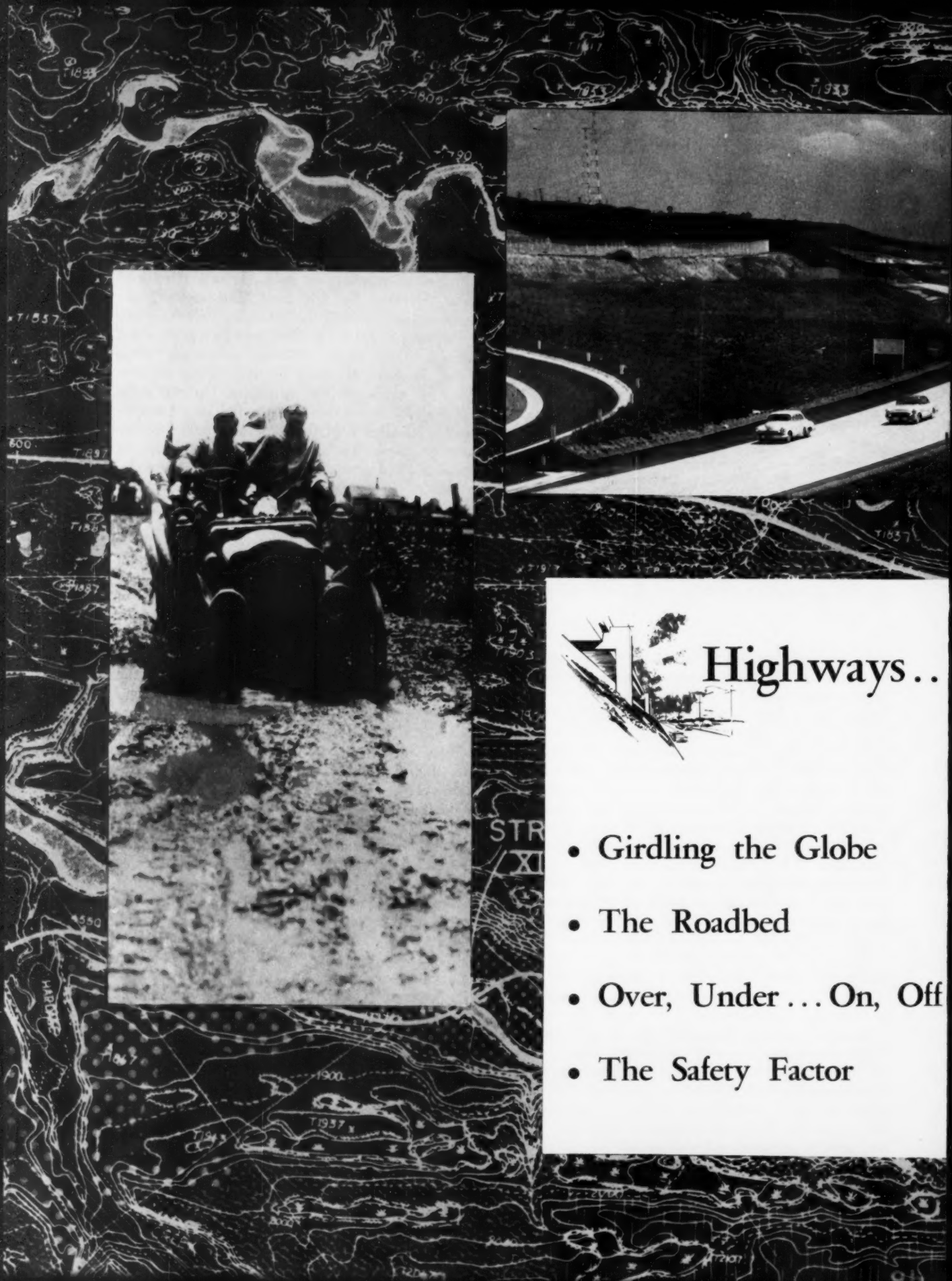
Instead of resorting to special, newly developed circuit breakers for this large load current, our engineers chose to split the low-voltage winding into two equal (12,500 kva) parts, and to use standard circuit breakers in the 4160-volt switchgear. Each of the duplicate 4160-volt windings feeds its own section of station service switchgear. Each of these twin bus sections feeds directly the larger motor-driven auxiliaries with the duplicates being fed by the other bus section. The engineering time spent on conceiving and comparing this scheme with others resulted in an estimated over-all saving of $130,000 per unit, on an installed basis.

Essentials Only

There is another type of economic service which the alert engineer can render. Because of his technical know-how and experience, he can safely eliminate devices not needed in the specific design. For example, surge protection equipment for generators and some large motors generally is economically necessary to prevent deterioration and eventual failure of the electrical insulation of this expensive equipment. In a particular layout, the location of nearby structures, the arrangement of static wires, and the convergence of incoming lines at a discrete focal point may blunt the harmful overvoltage wave so substantially that surge protection equipment becomes entirely unnecessary.

An important item in economy is the engineer's knowledge of technical details. He is the best evaluator of economy because in his daily work he deals with the characteristics, technical details, and costs of equipment. Popular concept may forget this important function of engineering. Nevertheless, clients often receive a better return on an investment when they retain in their budgets an item which allows the engineer to dream.

Reduction of engineering costs to the absolute minimum is simply bad over-all economics. The client and the public are poorly served when contracts are awarded in a form that discourages the investment of time in conceptual analysis and investigation of new approaches. Engineering can be expensive. Fundamentally, it should be. More than any other factor, it establishes and controls the over-all economy of the investment. ▲▲



Highways..

- Girdling the Globe
- The Roadbed
- Over, Under . . . On, Off
- The Safety Factor

Left — Photo from Automobile Old Timers shows a White Steamer negotiating some tough roads during the Glidden Tour of 1907. Above — A modern freeway in California, with broad right-of-way and shoulders, and six lanes of high speed traffic.

STAFF REPORT

THE WHISKEY REBELLION of 1794 put the United States on wheels, for one of its immediate results was the construction of the Philadelphia and Lancaster Turnpike. Completed in 1795, this was the first extensive broken stone roadway in the country. Essentially a farm to market road, it enabled local farmers to ship their corn without converting it to white lightning. In the ensuing 40 years, many other turnpikes were built. Most were financial failures, but they provided the overland transportation so desperately needed in a developing nation.

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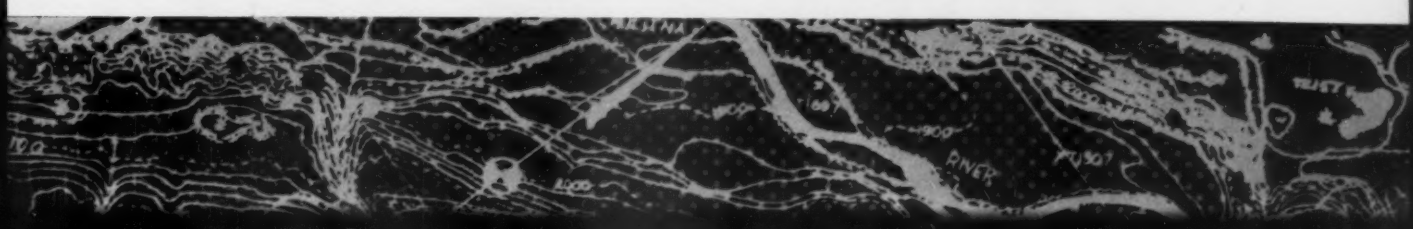
By 1806, under the reluctant leadership of Thomas Jefferson, the Federal government had moved into road building ("The Old National Road," CONSULTING ENGINEER, March 1959). Financing of a National Road was to be covered by earmarking for road construction 5 percent of the income from the sale of public lands in the newly admitted state of Ohio. From its conception until its final leg was completed in 1852, the National Road was rocked with scandal. Then, as now, the Federal watchdogs had extremely sensitive noses.

In 1830, the United States had about 27,000 miles of surfaced roads, and a highway building boom was in the making. But this was also the year of the iron horse, and soon the railroads had eclipsed the highways. It was over 70 years before the highway came back into its own. About 1904, automobiles came pouring out of the cities, tearing up the old roads and creating a demand for more and better ones.

In the interim, the petroleum industry had been born, and portland cement was being manufactured in the U. S. In 1893, concurrent with Duryea's first successful operation of an automobile and Henry Ford's first car, Bellefontaine, Ohio, laid the first portland cement concrete pavement. Railroad expansion had slowed down, and the U. S. was unconsciously pre-



paring itself for the highway age. By 1917, every state in the Union had its own highway department.

Continuous Federal Participation

Another first for 1893 was the establishment of Federal participation in road building on a continuous basis. What was then the Office of Road Inquiry now has become the Bureau of Public Roads. The beginning was small, for up to 1901 not more than $10,000 was spent in any single year.

In 1912, the Federal government took the grand step and allocated $500,000 for the building of roads over which mail would be carried. The states were required to put up two thirds of the cost of a project, and only 17 of them elected to do so. But those 17 anted up $1.8 million to build 425 miles of road. With this venture, the battle lines were drawn in the Congress, and for the next four years the pros and cons of Federal support for highways was discussed heatedly. In 1916, the Federal-Aid Road Act became law, and $75 million was appropriated for a five year period. Federal support was available to the states up to 50 percent of the road construction costs, with the proviso that total costs would not be considered above $10,000 per mile.

Two wars probably slowed the growth of Federal aid for highways, but with the adoption of the 1956 Congressional Act the picture rapidly changed. State and local government expenditures far outweighed those by the Federal government until that time. Now, it is predicted that the Federal government will foot the bill for 45 percent of all highway construction in 1961. And as the construction program rolls on, the states are left with a tremendously costly program of maintenance and administration.

Last year, the bill for our highway system ran to $10.7 billion. Construction and right-of-way acquisition totaled $6.3 billion; maintenance $2.6 billion; and administration and research the other $1.8 billion. In 1961, the Federal government will provide $900 million on a 50-50 matching basis to the states for the ABC or Secondary System of Federal aid roads. As of January 1, 1961, $4.7 billion had been expended on the Interstate System and another $5.2 billion was authorized or under way. An additional $112 million will be expended in 1961 for Federal highways on public lands.

Who Controls Our Highway Funds?

It is evident, at least financially, that the Federal tail is now wagging the state dog in the matter of highways. True, the relationship between the Bureau of Public Roads and the state highway departments has been good. The Congress reviews the Federal-aid highway program every two years, and the states are requested to express their recommendations – directly to Congressional committees, through the Governor's Conference, and through the American Association of State Highway Officials. The highway accomplishments are being realized under a working agreement that preserves for the states the jurisdiction and independence which the Constitution requires. But the fact still remains that, bureaucratically speaking, the Bureau of Public Roads is no longer a match for the state highway departments. There is strong evidence that the Bureau is overdollared and undermanned.

Highway departments are inflexible. Their function is to build roads, and many of them do it well. But we are reaching a point of diminishing returns with our highway investment. Over the past 10 years, motor travel has increased about 50 percent – highway expenditures have increased 114 percent. Soon we will have to look at other modes of transportation, and our highway departments will be out of business – at least on their present grand scale.

The Role of the Consultant

When our current highway program began, it got off the ground because inadequately staffed state highway departments made use of consulting engineers. Gradually this work was absorbed by the growing state departments, and the consulting engineers sought other work. By 1975, when the Interstate System is complete, the highway departments may have to do the same. We hope they will be as nimble.

Bengt F. Friberg says of the demise of the consulting engineer in the highway field, "Traditional limitation on government activities is repugnant to the social planners. Continuing pressure is exerted on those states which continue to resist building up large engineering departments, and employ consultants, in lieu thereof, to meet the extraordinary demands of the Federal aid program. From 1959 to 1960, contracts on the Federal aid system increased over 30 percent, but only three states, Rhode Island, Illinois, and Alabama, planned increased use of consultants, while 10 states drastically decreased or eliminated their use. Of 41 states for which 1960 plans were given, only 14 were using consultants to a noticeable degree (on projects totaling over 2 percent of construction), while 20 either used no consultants, or only so rarely as to give no apparent relief to the highway department."

However, consulting engineers never have abandoned highway work. Many states still use consultants as a matter of policy, others as a matter of expediency, and still others because they are simply unable to attract the necessary talent into their own departments. Thus, consultants still are making important contributions to highway design in the United States – often at a cost far below that of work done by government employees. American firms are also in great demand abroad. Of the $19.3 billion spent by the free world on highways in 1960, close to $4 billion was spent in developing countries – much of it on highways designed by U. S. consulting engineers.

Highways...

Girdling the Globe

WHILE THE UNITED STATES probably has done more than any other nation to pull itself out of the mud, it has not always been the leader in highway development. For example, Italy developed the limited access highway in 1924, and Holland and Germany followed in about 1930. Under Hitler, the German Autobahn gained world renown, for the Nazis were quick to grasp the strategic importance of good roads. Today, Holland has one of the finest four-lane divided highways in the world, running between Rotterdam and The Hague. It is a no speed limit road, with continuous lighting of three foot-candles — three times that of

Autopista del Este, the expressway that takes traffic from east of the city directly into the heart of Caracas, Venezuela.

The Motorway Plan for Britain, as it appears to be shaping up, is in real danger of being too little and too late.

similar lighting in the U. S. It is evident that highway progress is a globe girdling phenomenon.

Western Europe now has about 2200 miles of limited access highways, and proposes to build 4000 more in the next 10 to 15 years. Comparable to our own Interstate System is the plan for a 26,000 mile connected system to serve all of Europe. Preliminary planning began in 1950, and many sections of the system have been completed. More recently, planning got under way for a Pan-Asian Highway that will be tied into the European System ("Planning the Pan-Asian Highway, CONSULTING ENGINEER, November 1960).

Perhaps the most beautiful highway in the world is Italy's Highway to the Sun (CONSULTING ENGINEER, July 1960). It eventually will run from Milan to Naples. Closer to home are the highways of South and Central America. Most significant is the Inter-American Highway from Laredo to Panama City. It is expected, with recent appropriations for bridges in Costa Rica, that the 1555 mile road will be completed in 1962, with 1200 miles of pavement, 355 of gravel surface, and all bridges and drainage structures open for automobile and truck traffic.

All over the world, modern highways are snaking through dense jungles, climbing over steep mountains, and crawling across shimmering deserts. Meanwhile, back in Britain, angry motorists still are riding on the roads of the Roman Legions.

Britain's Highway Hassle

Until only three or four years ago, Britain's sole concession to the traffic problem was the construction of a few bypasses and the widening of existing roads at critical points. Apart from the excellent system of trunk roads built by the Romans about 2000 years ago, no attempt ever was made to construct through highways to speed traffic from one part of the country to another, or even between cities.

Only when Britain's first motorway (Route M-1) was planned did a new era in highway construction get under way for the country's harried motorists. Surprisingly enough, the new road paralleled both the old Roman road that was the main highway from Dover through London to Chester, and the first trunk railroad ever built (1834), linking London with industrial Birmingham.

M-1 was under fire from the House of Commons almost immediately after it opened. A Committee of Public Accounts found that the cost of M-1 went up from an estimated $35 million in 1955, to $49.28 million in 1957, and an actual construction cost of $60.2 million when it was completed at the end of 1959. The consulting engineers' fees, established on a percentage of construction cost, rose from a projected $1.69 million to $2.1 million.

Turned loose on their first superhighway, British motorists soon earned for M-1 the unenviable title of "Murder Way." This, too, roused a great hue and cry, but, just a little more than a year later, the accident rate for M-1 was estimated at about 7 per 10 million vehicle miles, compared with nearly 15 on other roads.

British Planning Lags

The fact remains, however, that new roads in Britain are being built in accordance with planning that is "wildly out of date." Calculations by the British Road Federation show that improvements to the Great North Road are costing about $0.7 million per mile, while M-1, running through similar country and with three instead of two lanes each way, cost $0.78 million per mile. Thus, it is evident that an entirely new road, preferably with limited access, can be built almost as cheaply as rebuilding existing roads – and still leave the old roads available for local traffic. This economic fact seems to evade the grasp of Britain's planners.

In spite of this economic logic, most of the highway planning in Britain is confined to new all-purpose roads which are out of date before they are built. At the present time, nearly a quarter of the 6500 miles of the rural trunk highways in England and Wales are carrying more than twice the capacity limit recommended by the Ministry of Transport, and five or six

percent are carrying three times their capacity. Thus, it is argued that Britain must spend $1 billion a year on new limited access roads. This is a far cry from the present total annual expenditure of only $140 to $170 million.

Highway Progress in Sweden

In Sweden, a detailed plan for a national highway system was developed in 1957. As a result, about $1.25 billion has been allocated over the period from 1958 through 1967 for development of state roads and local roads and streets. In the following 10 year period it is anticipated that expenditures will rise to a total of over $2 billion.

As in most countries, politics rears its head in the Swedish highway program. However, in spite of Sweden's heavy emphasis on socialism, it is estimated that as much as 15 percent of the civil engineering work for the highway program is in private hands. There is little to indicate whether this will increase or decrease, but there is a growing tendency among young engineers in Sweden to avoid government service. Also, the consulting firms in the highway field have expanded their staffs from 25 to 40 percent over the past two years.

Highway Work Goes to Large Consultants

Most of the highway work in private hands is concentrated in the large consulting firms. Among those active in the field are Orrje & Co., Allmanna Ingeniorsbyran AB (AIB); Kjessler & Mannerstrale AB (KM); Viak; and Per Olow Klevemark, doing traffic work.

Currently, the consultants are standing fast in a fee battle with government officials. The latter would like to establish lump sum fees, whereas the consultants prefer to base their fees on a percentage of cost basis. It appears to be in the traditional 2.5 times cost area, with travel and document expenses added. Accounts are being rendered on a monthly basis, with some running as long as three months.

Currently, Viak's biggest project involves about $4 million and will take about two years for a project group averaging 10 to 12 men. Orrje has at least one man who specializes in traffic study, in addition to its conventional highway work. This firm, which was formed in 1948, now has 40 partners and a staff of about 450, of whom 200 are engineers. Some 50 engineers are currently at work on highway projects. Kjessler & Mannerstrale AB, which just completed the design for a $60 million stretch of highway, is a firm with 12 partners and 335 employees. KM was formed in 1938 with 10 engineers; it now has 210. At Allmanna Ingeniorsbyran AB there is heavy emphasis on soil mechanics. The firm, a huge one, was founded in 1901, and its offices span the country.

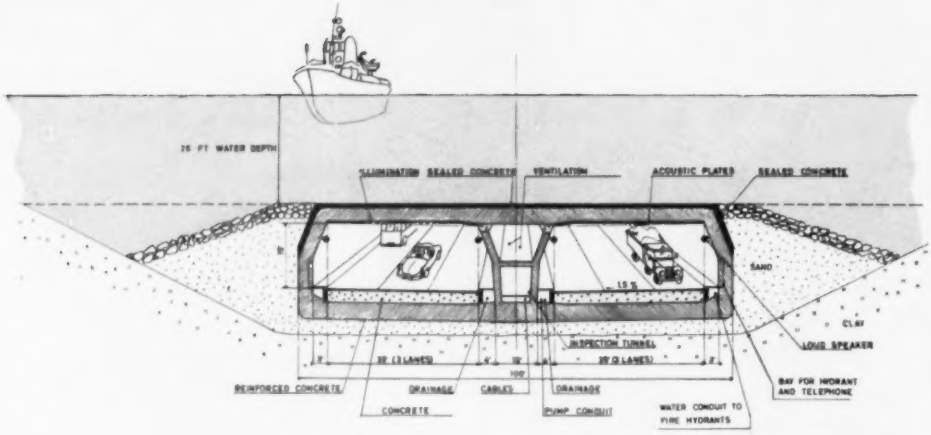
Currently at least, the highway situation in Sweden looks good for the private practitioner. Whether it will follow the pattern in the U. S. remains to be seen.

Freeway Through Gothenburg

In 1956, the city of Gothenburg and its suburb of Molndal commissioned to KM Consulting Engineers the planning of a seven-mile freeway through the two cities. The combined engineering resources of the two cities were not sufficient to handle this project in

Pan American Union photo of a tree lined asphalt road located in the Province of Mendoza in western Argentina.

Pan American Highway offered a major engineering challenge in this section traversing Chilean desert country.



Sweden's Gothenburg Tunnel will be floated into place in five sections for sinking in riverbed excavation. Tunnel was designed by Kjessler & Mannerstrale AB with Christiansen & Nielsen of Denmark.

addition to the many other projects which were demanded by the rapid growth of traffic. The cost of the engineering design was underwritten by the Federal government.

The general plan of this freeway is now complete, and a more detailed plan for the northern part, two-miles long, was hurriedly completed so that construction could begin in January 1961. The entire project will cost about $60 million, including right-of-way. There will be 10 interchanges, all constructed with grade separations. The central part of the freeway has six lanes and sometimes eight; the peripheral part four lanes. The freeway is designed for 1985 traffic, and 95 percent of the ultimate cost will be appropriated from Federal funds.

The first stage of the project, with a construction cost of $34 million, includes four interchanges and a new, six-lane, 1510-ft tunnel. While the tunnel is under construction, a six-lane suspension bridge designed by KM will be under construction in the western part of the city.

In the first stage, the southern part of the system will consist of widened existing streets with a few grade separations. In the final stage, an existing two-track trunk line railroad will be moved into a one-mile long blasted tunnel. To facilitate faster handling of goods, an additional track will be added. The freeway then will use the area previously occupied by the railroad.

Geometric Standards

The geometric standards will facilitate easy movement of a large volume of traffic — about 90,000 vehicles daily. Exits and entrances have deceleration lanes and acceleration lanes, and the length of the acceleration lanes will permit vehicles to reach a speed within 10 mph of the speed on the through lanes. Another interesting design feature which has to be taken into consideration is that Sweden probably will change soon from left hand traffic to the more common right hand traffic. Therefore, all interchanges, including the ramps, are designed for both left and right hand traffic in order to save money if and when this change occurs.

The Tunnel

From a technical viewpoint, the tunnel under the Göta Alv river is the most interesting part of the system because it will be the first highway tunnel under water in Sweden. It was planned by KM Consulting Engineers, together with the famous tunnel constructing firm of Christiansen & Nielsen, of Denmark, which has a fine reputation for tunnel construction in Rotterdam and Vancouver.

The soil in the river valley is a type of lean clay, and the depth to rock foundation is over 300 feet. The tunnel will be constructed so that it will weigh exactly as much as the clay excavated from the river bottom. Thus, there will be no additional load on the ground, since the load caused by the traffic through the tunnel is negligible when compared to the weight of the tunnel.

Construction of the tunnel, in five parts, will proceed at a special dock. The five sections, furnished with temporary walls at the ends, will be floated on the river to the site where the excavation has been prepared. The parts then will be submerged, the temporary walls will be removed, and the sections will be fitted together.

The Engineering Staff

During the first part of the planning stage, 1956-1960, the traffic planning division of KM engaged an average of 10 persons, half of them with bachelor's or advanced degrees. The latter part of the planning stage, which recently started, includes detailed design. About 30 people will be engaged continuously on this phase of the work.

Highways . . .

The Roadbed

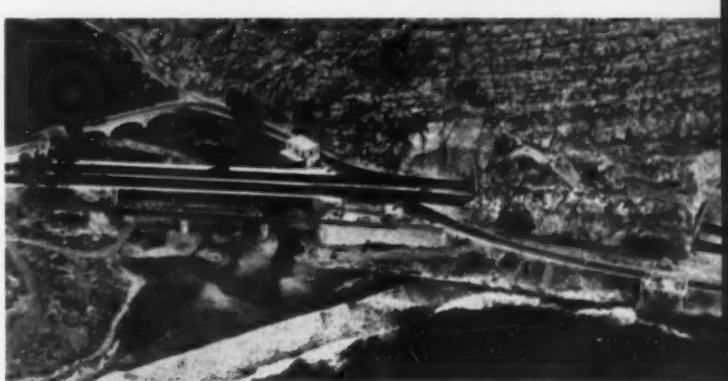
Terrain model constructed by New Jersey State Highway Department shows advantages of preferred location for Route 24 Freeway at Brooklake Road area of Florham Park. Road, which was designed by Howard, Needles, Tammen & Bergendoff, will replace New Jersey's historic Morris Turnpike.

ORIGINALLY, the American Highway was little more than a feeder line for railroads and a convenience for cities. Today, it is a vital factor in our economy and of great strategic importance to the military. In addition, we have come to expect good highways as a necessary adjunct to our recreational activities.

Modern highways no longer follow the meandering paths of the cattle drover. Highway location is a compromise between engineering feasibility and the demands of many pressure groups – economic, political, military, and sometimes even public. Certainly the most economical road, in terms of design and construction, is not always the best. For example, when Tippetts-Abbett-McCarthy-Stratton and Mark Hurd Aerial Surveys, Inc. collaborated on the Alaskan Willow-Summit Highway Project, an important goal in location studies was the opening up of potentially rich agricultural areas and the proper location of a major bridge so that it eventually would serve a proposed highway to the west. Thus, a more costly route will reap untold economic benefits for Alaskans.

Many other factors affect road location. When TAMS went into Lebanon on a project jointly sponsored by the U. S. and the Lebanese governments, the big problem was the preservation of some priceless antiquities. In the region of the Nahr el Kelb (Dog River), plaques had been carved in the living rock to record the course of ancient battles. It was necessary to design twin tunnels to permit passage of a four lane highway under the area occupied by these antiquities.

Aesthetics, too, is important, and it controlled to a great extent the Clarkeson Engineering Co., Inc.,



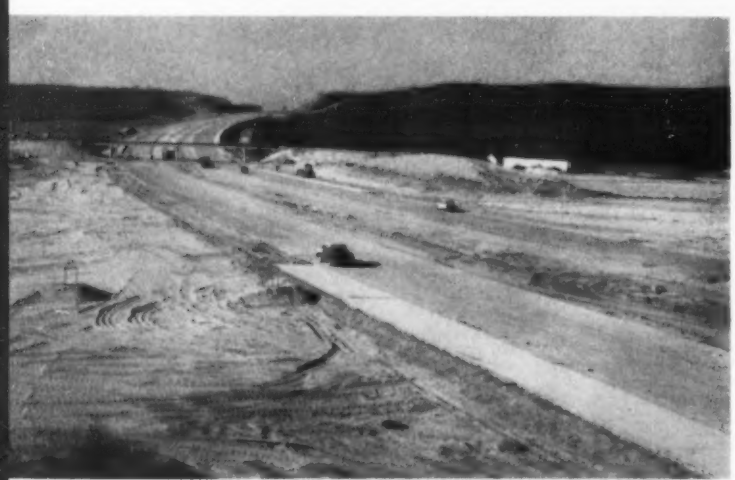
Preliminary studies and investigations and final design for the Nahr-el-Kelb Bridge in Lebanon were done by the engineering firm of Tippetts-Abbett-McCarthy-Stratton.

Aesthetics was an important factor in Clarkeson Engineering Co. design of new highway through Franconia Notch.

design of a dual roadway section of the Interstate Route through the famous Franconia Notch. Less pleasing a prospect was the discovery of a private graveyard, containing 14 bodies, during the construction of the six-lane Long Island Expressway. Had Lockwood, Kessler & Bartlett, Inc., the designers, known of this grisly find, the road most surely would have been rerouted — especially if next of kin had been aware of the situation.

Construction Progress Affects Planning

The tremendous strides made by the construction industry also have affected highway location, particularly in the development of low cost earth-moving equipment and techniques. When Interstate Route 93 was being designed through the town of Methuen, Massachusetts, Duffill Associates, Inc. called for a profile which ranged from a deep 50-ft cut to a 60-ft embankment through a peat meadow approximately 40-ft deep. Peat excavation was in excess of 1 million cubic yards and borrow in excess of 3.5 million cubic yards. It was one of the largest excavation and borrow contracts ever undertaken in the state of Massachusetts.



Lockwood, Kessler & Bartlett, Inc. designed section of Long Island Expressway, where graveyard was found.

An even more impressive amount of earth was moved when U. S. 69 was relocated (along with the Missouri-Kansas-Texas Railroad) through the Eufaula Reservoir, in Oklahoma. Working with the Corps of Engineers, the firm of Hudgins, Thompson, Ball and Associates specified two river crossings which entailed the placing of 18 million cubic yards of fill for embankments.

Such projects would have been financially inconceivable only a few years ago, before the era of high capacity earth-moving equipment. Thus, the design engineer is offered many new approaches because of developments in the field of construction.

Other Advances

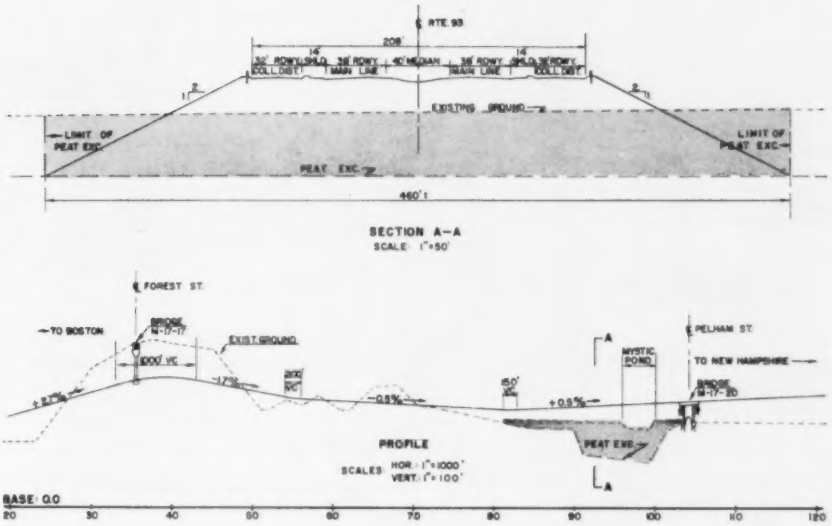
The solution of location problems has been simplified by the development of aerial photography and electronic surveying. But the demand for better roads with smoother and more efficient traffic patterns also has spurred the development of traffic engineering. In heavily populated areas, the traffic study has become indispensable, and it plays a major role in unsettled areas because roads must be designed for the traffic of the future rather than the present. The lack of careful traffic engineering on roads of even the recent past already has created an amazing mileage of inadequate roads.

The Role of Soil Mechanics

Soil mechanics probably has contributed more benefits and more confusion to highway design than any other field. In a facetious vein, Ray O. Maurseth, of Maurseth & Howe, has estimated that 1 million drivers hit 10 billion bumps per year — or, on an individual basis, each driver hits 10,000 bumps a year. What our highway program really needs he points out, is bump specialists.

Certainly, the bumpy road has been the cause of much research. Contemporary texts discuss comparison diagrams showing the interrelationship between soil bearing values and classifications based on Cassagrande, P. R. A., Westergaard's "K", subgrade bearing values, Sheet's "C", Porter's "CBR", Hveem's "R", and so forth. Yet, without all these, the Romans were able to build roads on which the traffic of Britain still rolls today. It is worth noting, too, that the old Roman roads have a thickness of rock base which agrees quite well with that of present day highways designed for moderate traffic.

The soils engineer can hardly keep pace with the development of new laboratory equipment designed



Duffill Associates, Inc. designed this section of Interstate Route 93, where one of the largest peat excavations ever undertaken in Massachusetts was required. A peat meadow over 40-ft deep required excavation of over 1 million cubic yards.

to meet the exacting requirements of new tests. As a matter of fact, however, there is strong indication that the soils engineer needs a better understanding of the limitations of a test than of the test itself. Certainly, the consultant in this field cannot write a suitable specification for such a simple element as relative compaction unless he fully understands the limitations of the laboratory tests.

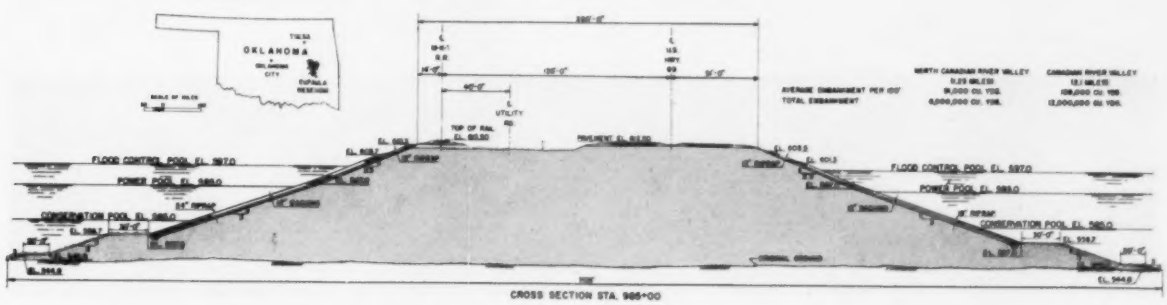
One of the most important factors in present highway design is the application of drainage studies to ultimate pavement design. Most pavement designs, predicated on soil tests, allow for some reduction of base thickness when drainage conditions appear favorable to the engineer. Although some progress has been made on the correlation between drainage and soil reactions, there is a need for more acute analysis and a broader application of engineering judgment.

The development of a satisfactory approach to soil mechanics does, of course, owe much to laboratory research. However, there is some justice in the criticism of too much reliance on laboratory tests. If the soils engineer is to maintain his professional status, he must continue to exercise his right to engineering judgment – as he does on many important projects in the highway field.

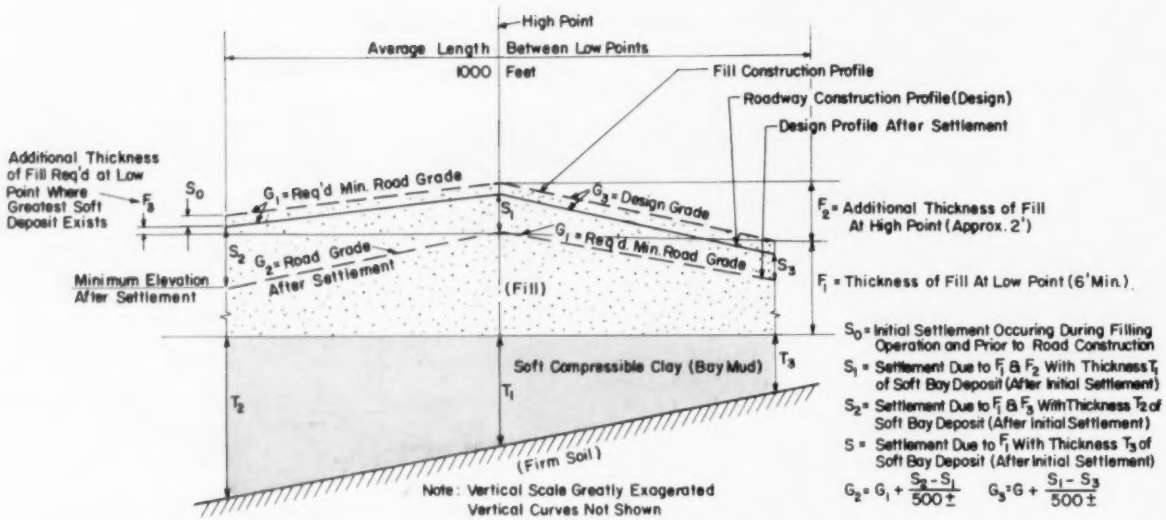
The Rollins Road Project

Rollins Road is a major industrial roadway, one-mile long, running between Millbrae and Burlingame, California. When the consulting firm of Wilsey, Ham & Blair undertook design of the project, it found that the ground over which the road was to pass consisted of soft clay deposits, varying in depth from 5 to 30 feet. Because of this variation in depth of the soft compressive layers, it was anticipated that area settlements up to 25 inches, and differential settlements up to 16 inches, would occur. Additional local settlements also were expected due to the existence of old waterway channels.

A detailed soils investigation, including careful laboratory studies of soil borings, was the basis for plotting settlement curves indicating anticipated 20-year settlements for varying depths of fill versus depths of the underlying roadway. Three profiles of



Hudgins, Thompson, Ball & Associates designed this embankment, which required 18 million cubic yards of earth fill.

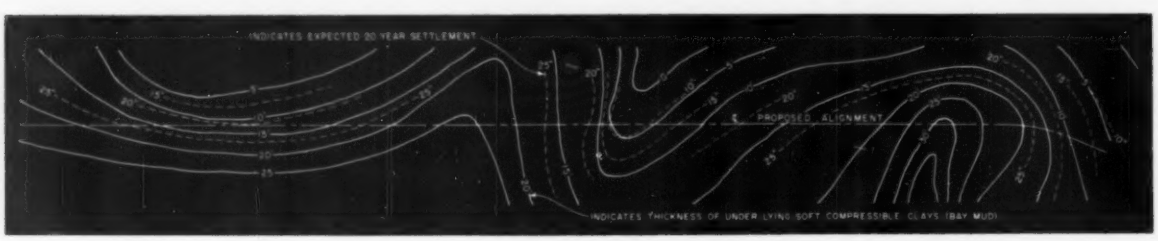

High Point
Average Length Between Low Points
1000 Feet
Fill Construction Profile
Roadway Construction Profile (Design)
Design Profile After Settlement
Additional Thickness of Fill Req'd at Low Point Where Greatest Soft Deposit Exists
F_3
S_0
G_1 = Req'd Min. Road Grade
G_2 = Design Grade
S_1
F_2 = Additional Thickness of Fill At High Point (Approx. 2')
S_2
G_2 = Road Grade After Settlement
G_1 = Req'd Min. Road Grade
S_3
Minimum Elevation After Settlement
(Fill)
F_1 = Thickness of Fill At Low Point (6' Min.)
S_0 = Initial Settlement Occuring During Filling Operation and Prior to Road Construction
S_1 = Settlement Due to F_1 & F_2 With Thickness T_1 of Soft Bay Deposit (After Initial Settlement)
S_2 = Settlement Due to F_1 & F_3 With Thickness T_2 of Soft Bay Deposit (After Initial Settlement)
S = Settlement Due to F_1 With Thickness T_3 of Soft Bay Deposit (After Initial Settlement)
Soft Compressible Clay (Bay Mud)
T_3
T_2
T_1
(Firm Soil)
Note: Vertical Scale Greatly Exagerated
Vertical Curves Not Shown
$G_2 = G_1 + \frac{S_2 - S_1}{500 \pm}$ $G_3 = G + \frac{S_1 - S_3}{500 \pm}$

Wilsey, Ham & Blair handled the design for Rollins Road, which passes through marshy ground overlying bay mud.

the proposed roadway then were prepared, showing the elevation of the existing ground and the depth of mud along the proposed route.

First a preliminary design profile, after settlements had occurred, was prepared. This consisted of a ripple pattern of alternate high and low points, providing surface drainage and holding the general elevation of the road to a minimum to reduce fill required in adjacent areas. Highs and lows in the ripple pattern were located to take advantage of differential settlements wherever possible, and street grades were set at the minimum allowed by local public agencies.

Next, a roadway construction profile was prepared, with anticipated settlements at each of the stations along the roadway taken from the soils curves and added to the first profile. Road gradients were adjusted accordingly. The adjusted profiles then were checked to be sure they met minimum fill requirements for structural stability and also minimum allowable street grades, both at the time of construction and after settlement had taken place. Storm and sanitary sewer profiles were then drawn, added to this drawing, and adjusted to account for the settlement so that their minimum grades would be maintained after settlement. Where anticipated settlements were favorable, the design grade was set at the minimum allowable, so that the ultimate grade would be greater than this amount. Where settlement was adverse, the


INDICATES EXPECTED 20 YEAR SETTLEMENT
PROPOSED ALIGNMENT
INDICATES THICKNESS OF UNDERLYING SOFT COMPRESSIBLE CLAYS (BAY MUD)

Thickness of bay mud and 20-year settlement contours along Rollins Road, between Millbrae and Burlingame, California.

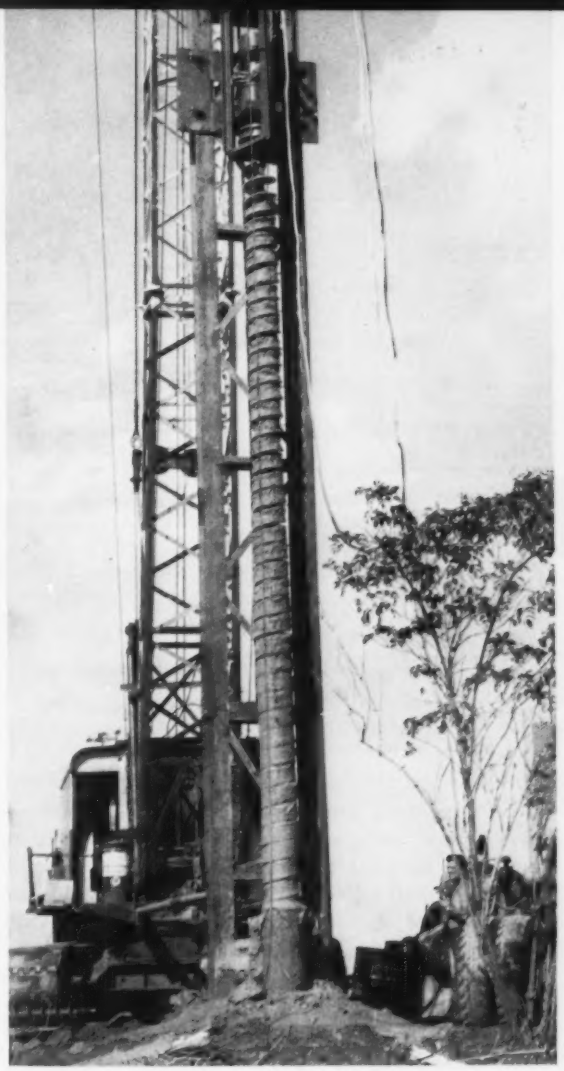
design grade was adjusted to be steeper than the minimum allowable so that after settlement the ultimate grade would be the minimum allowable.

Later, from data obtained during placement of the fill, it was determined that the design profile should be surcharged to allow for both the initial settlement and that which would occur between the time the fill was placed and actual road construction begun. This was necessary to meet design grades.

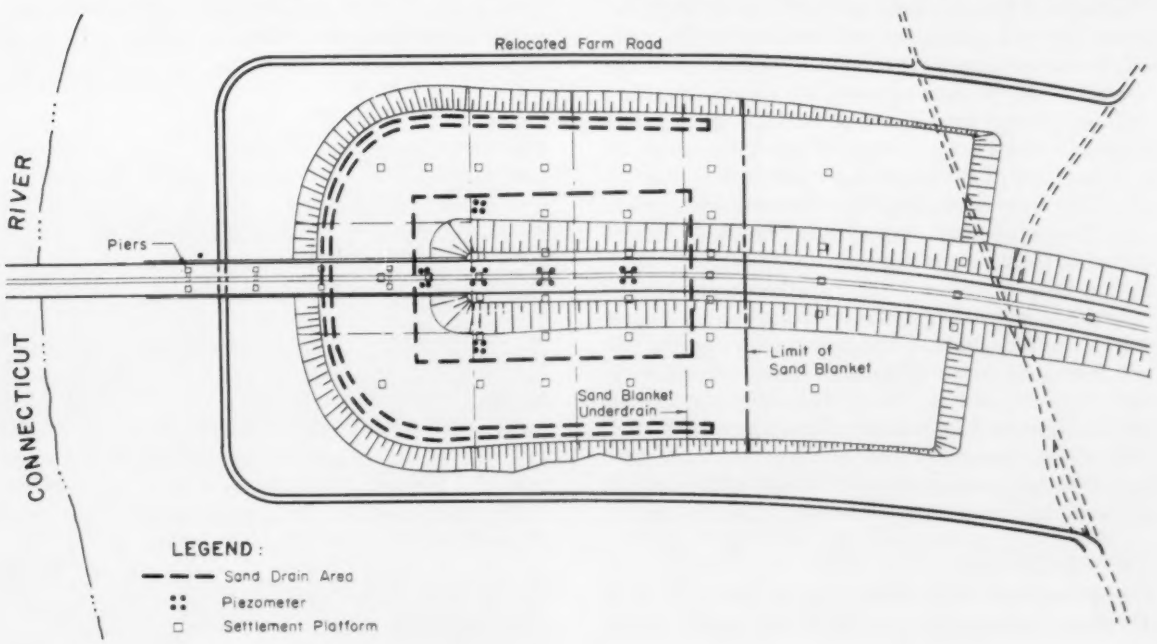
Preparing the Site

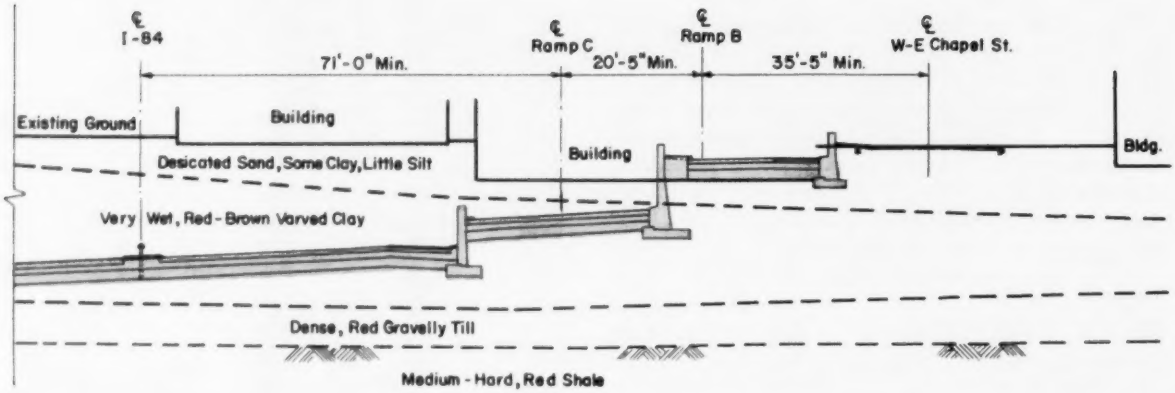
The Site preparation consisted of draining and filling the existing drainage ways with local compressible clays before the placement of fill. Fill was placed directly on the existing natural vegetation covering the area, and settlement plates were put in place before filling began. About 2 million cubic yards of sandy to sandy loam fill were placed on the roadway and adjacent areas. Placement was in lifts of from 6 to 8 inches, with compaction to 95 percent of the standard AASHO maximum dry density. A flexible pavement was placed, consisting of 3 inches of plant mix surfacing and 6 inches of crusher run base. This was placed on a minimum of 6 feet of controlled fill.

Five years of experience under heavy commercial traffic indicates that the design precautions and construction procedures have produced a very satisfactory roadway over difficult terrain. The original ripple pattern is developing as anticipated. All utilities are functioning properly, and there are no sagging



Goodkind & O'Dea engineered sand drain installation on bridge approach in Connecticut.





Capitol Engineering Corporation designed fully depressed highway through the city of Hartford, Connecticut. Typical section shows problem created by stratum of varved clay. Construction cost of half mile section may be $5 million.

curbs, dipping gutters, and bird baths — conditions often associated with roads crossing mud flats.

An Unusual Sand Drain Application

On the eastern approach to the Wethersfield-Glastonbury Bridge, over the Connecticut River at Glastonbury, Connecticut, soils investigation showed that foundation material consisted of a stratum of sand varying from 40 to 50 feet in thickness overlaying an 80-ft layer of varved clay. Studies indicated that serious settlement might occur after completion of the approach if special techniques were not used.

Goodkind and O'Dea, consulting engineers on the project, decided to specify sand drains in an area about 600-ft wide by 700-ft long. However, since conventional driven casing probably would drag clay across the thin layers of silt and make the walls of the drains impervious, it was specified that the drains could be formed only by means of rotary drilling, jetting, or other method which would produce a clean hole with a minimum of disturbance.

Since most of the drains were 120-ft deep, the excavation of holes required that the contractor, White Oak Excavators, Inc., display considerable ingenuity. After extensive experimenting, a continuous auger, with a 14-in. diameter casing, was driven through the sand layer and into the clay only far enough to seat itself. The remainder of the hole was excavated with a 124-ft long auger suspended from specially designed leads and powered with its own electric motor. As each hole was completed, it was checked with a chain suspended weight.

Anticipated settlement and actual settlement on the completed project were in very close agreement.

Fighting Fluid Clay

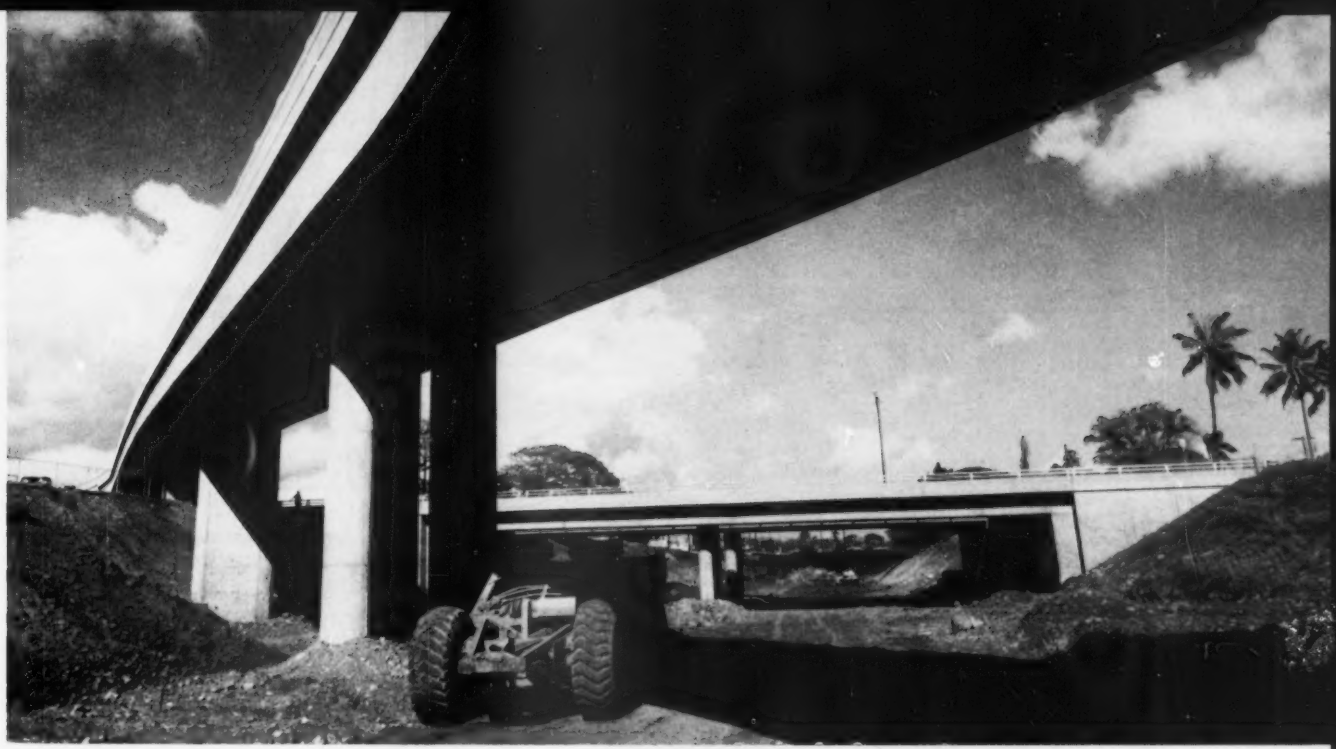
Design Section 1 of the East-West Highway, through Hartford, Connecticut, is a half mile stretch which probably will cost $5 million, exclusive of right-of-way acquisition and utility relocation. It was designed for the Connecticut State Highway Department by Capitol Engineering Corporation. Construction will get under way soon and will proceed in seven stages.

Design Section 1 is fully depressed, and runs through the central business district of Hartford. Thus, extreme care was used in the soils testing and foundation investigation, on which the firm of Haley and Aldrich collaborated. The roadway must pass through a thick stratum of varved clay that is very fluid. This necessitated the design of retaining walls and bridge abutments using equivalent fluid weights of 80 pounds per cubic foot. Design requirements made it necessary to consider using passive resistance values in analyzing for sliding. A minimum factor of safety against sliding of 1.5 was used in the design.

Soil Problems in France

Soil studies were also an important part of France's new Autoroute to the South. Presently, 26 miles are completed, involving 5.23 million cubic yards of earthwork. Some of the cuts traverse unstable sandy soils, and others the limestone rock and dense clay that are typical of the geology of the area. Careful preparatory work was required at several points for placement of fill. In the Essone Valley, the swampy bed and borders of the Ormoy Lake needed to be dredged to a depth of 16½ feet.

Most of the road was concrete, placed on a sand bed that was stabilized at some points by the addition of 5 percent of cement to a depth of 4 inches. Transverse drains and drain wells for the longitudinal drains below the road shoulders, located in cuts, provide for drainage. Flexible pavement was substituted for concrete at some points, because of anticipated settlement problems.



Tudor Engineering Co., in a joint venture called Law and Wilson-Tudor-Towill, designed two sections of Lunalilo Freeway, one including Hawaii's first three level interchange. Construction costs are estimated at $17 million.

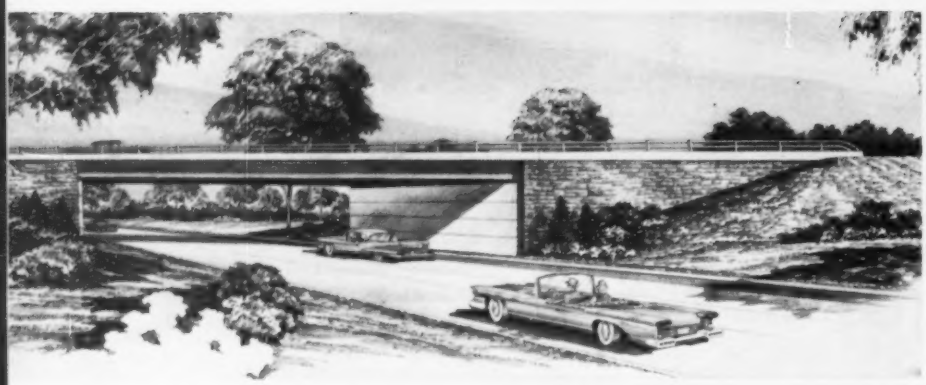
Highways . . .

Over, Under . . . On, Off

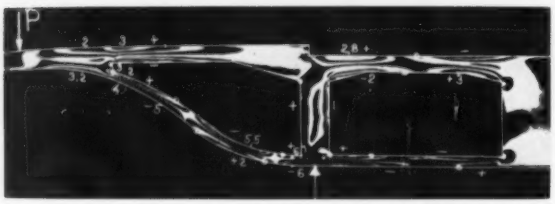
Parsons, Brinckerhoff, Quade & Douglas designed New Hampshire Turnpike with spacious overpass openings, contrasting sharply with old U. S. 30 railroad overpass.

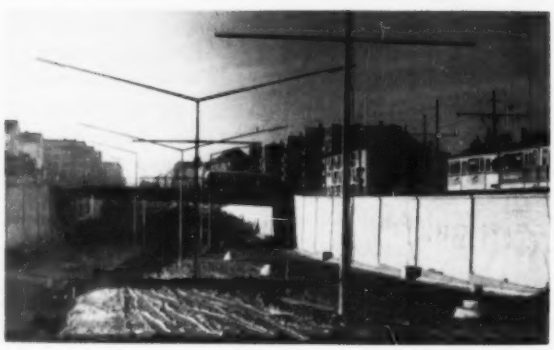
THE DESIGN AND CONSTRUCTION of grade separations and interchanges is beset by many pressures — the greatest of which is rising costs. When Parsons, Brinckerhoff, Quade & Douglas designed the New Hampshire Turnpike, which opened in 1950, only three one-degree curves and 17 rail and highway grade separations were needed in its entire 15 mile length. The dual limited access highway was laid out on a 300-ft right-of-way, with two, 12-ft lanes in each direction, separated by a 24-ft depressed median strip. The median strip provides space for the storage of snow during winter months and also carries the continuous drainage system. Cost of construction was under $400,000 per mile.

In 1958, when Virginia opened the Richmond-Petersburg Turnpike — also designed by Parsons, Brinckerhoff, Quade & Douglas — the 35-mile long road averaged $1.4 million per mile. This is not a very startling figure in 1961, but it is 3½ times the cost of the New Hampshire Turnpike. Most of this difference was caused by the fact that the Virginia facility required 95 crossings. Thirty four structures



Architectural studies of overpasses. At left is Howard, Needles, Tammen & Bergendoff study for the Potomac River Bridge Project; at right, Goodkind & O'Dea study for Onandaga Interchange. Designs are practical – pretty.





Dr. Ing. P. Walter did plastic model stress analysis for overpass in Essen. Illustrations show stress and scale models, as well as view of the area during construction.

carry the turnpike over waterways, highways, and railroads; 38 carry intersecting roads, railroads, and pedestrian walkways; five bridges carry access roads over intersections; and 18 culverts provide for stream and utility crossings. The cost of the Virginia and New Hampshire turnpikes is almost in direct ratio to the number of structures.

Current traffic volume and speed, and public interest in safety, have all but wiped out the one-way railroad underpasses which were so common only a few years ago. Instead of narrowing under the railroad, most roads widen. This is an example of what self appointed highway experts presently are decrying as expensive frills. Highway structures have, indeed, grown more expensive – they also have grown safer, larger, more complex, and more beautiful.

In this latter area, the area of aesthetics, great strides have been made in the design of highway structures. Spans are longer and more graceful. Reinforced concrete appears in shapes more pleasing than the traditional T sections. And design of structures in steel has veered away from the traditionally boxy deep beam.

Much of the new beauty of highway structures has been brought about by advances in computer technology. The computations for curved structures with super-elevated roads offer no serious obstacles to the engineer who can feed his data into a high speed computer. In addition, the speedup of calculation time allows for more economical design, particularly in the trial-and-error computations required for statically indeterminate structures.

For structures that are not subject to classical analysis, model tests are being widely used. This is particularly true of some of the structures currently being designed in Germany. Dr.-Ing P. Walter, a consultant in Essen, is widely known for his work in this field. In his laboratory, photoelasticity or electrical strain gauges are used to measure stresses in

models. These then are interpolated for use in the design of the full-scale structure.

Space Shortage Forces Highways Overhead

Many highways are going elevated, because of a growing shortage of space. The 7.1-mile long Bruckner Expressway, designed by Howard, Needles, Tammen & Bergendoff, is a $70 million construction project connecting some of New York City's most important expressways. Much of it will be elevated, with no intersections at grade. Another interesting elevated highway is the one running through the narrow and steep-walled Lehigh Gap. For 1200 feet, the northbound lane will be cantilevered over the southbound on steel beams, because of limited right-of-way.

But expressways also are going underground, as does the Cross Bronx Expressway approach to the new Throg's Neck Bridge, designed by Lockwood, Kessler & Bartlett, Inc. Over it a major street intersection was left on existing grade. A three-level crossing was the solution developed by Michael Baker, Jr. at the intersection of Broad Street and Roosevelt Boulevard Extension in Philadelphia. Broad Street traffic and the Broad Street subway both roll over the Roosevelt Boulevard Extension.

Underpasses Also Solve Space Problems

In Long Beach, California, the extension of a runway at the municipal airport required the construction of two underpasses, one 904-ft and the other 1083-ft long. Each underpass is buried so that the roof carries the paving for a section of the airport runway and an adjacent taxiway. Moffat & Nichol, Long Beach consulting firm, selected a hypothetical aircraft of 450,000 pounds gross weight for the rigid frame designs.

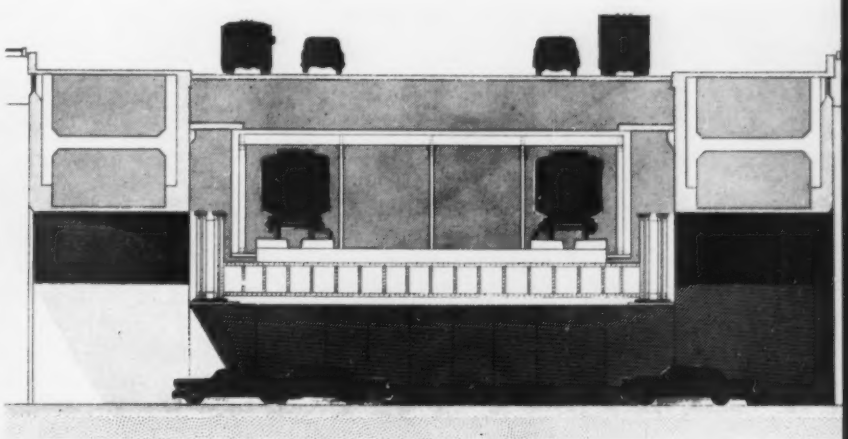
Exhaust ventilation is provided for each underpass. The air is drawn through gratings placed in the sidewalks and ducted to large concrete conduits under the roadway, which in turn lead to a ventilation building at one end of the underpasses. The top slab of the conduit carries one of the lanes of traffic in each direction. Automatic controls activate the fans when carbon monoxide concentration rises to a specified level, and one third of the fan capacity is operated automatically every 5 minutes.

Lighting is controlled by banks of photoelectric cells, with 15 foot-candles provided for cloudy days and 3 to 5 foot-candles at night. To allow motorists to adjust to light change on sunny days, 60 foot-candles is provided for the first 150 feet, dropping off to 30 foot-candles at the exit. Cost of the entire project was $3.5 million.

Boston's inner belt Central Artery has an underground section which is 2400 feet from portal to por-

Lockwood, Kessler & Bartlett maintained street grade for intersection and ran the Cross Bronx Expressway below.

Howard, Needles, Tammen & Bergendoff designed box girder for the Bruckner Expressway.



Michael Baker, Jr., Inc. designed this three level crossing at Broad and Roosevelt Boulevard crossing in Philadelphia. Note deep girders.

Long Beach, California, airport runway and taxiing area extend over this underpass designed by Moffat & Nichol.

tal. Designed by Fay, Spofford & Thorndike, Inc., this vehicular subway has a clear span roof of 45 feet for each roadway, with an increase to 75 feet where ramp junctions occur. Maximum width of the structure is 160 feet when ramp junctions occur on both roadways simultaneously, making it what is believed to be the widest subway in the United States — and perhaps the world. Main structural members are rigid frames of structural steel, spaced on 5-ft centers. Columns and invert beams are encased in reinforced concrete, but roof beams are left exposed in order to reduce the dead weight, which is critical. The roof must carry a 3½-ft deep cover, as well as live loads from the roadways above.

California's Experience With Interchanges

California is the land of the brave, the home of the freeway, and the changer of the interchange. The state's high speed, long distance commuters long ago earned the fear, if not the respect, of their counterparts in Chicago and New York. Lacking an adequate mass transportation system, California was forced into the automobile, and its larger cities felt the traffic squeeze long before it was felt in the major metropolitan areas of the east and midwest.

One of the early interchanges constructed in California was that at the end of the San Francisco-Oakland Bay Bridge. Completed in 1936, it was a three level structure with two of the major cross movements of traffic handled by weaving sections about 550-ft long. The public was never happy about making this weave, but the design served well enough until the postwar boom got under way. In 1955, construction was completed on a revised design that eliminated the two weaving sections.

Wherever possible, California interchanges now are designed without weaving sections, for today's traffic volume simply does not lend itself to this device. It is a hard lesson from experience, and just one of many the Californians have learned in their pioneering efforts. The California Department of Public Works now recognizes four important elements in freeway interchange design:

¶ Avoid weaving to provide for major turning movements and carefully scrutinize all freeway designs for possible restrictive weaving sections.

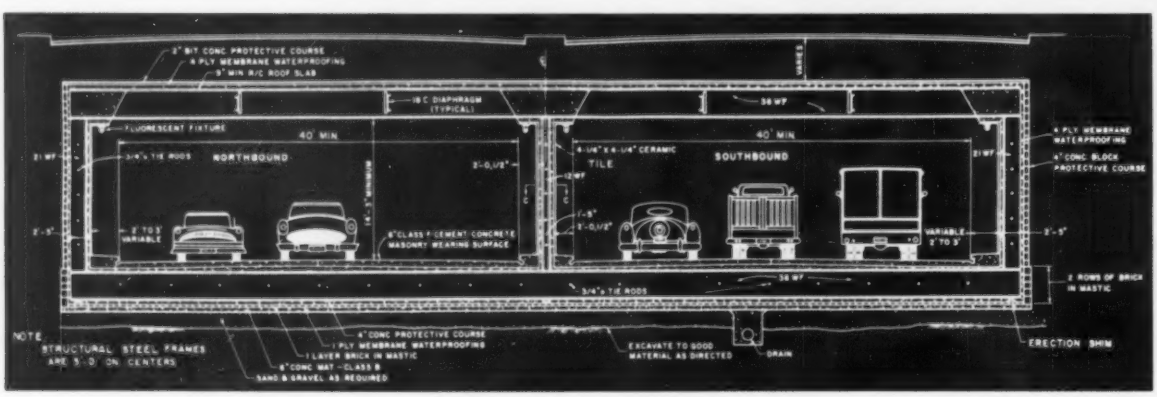
¶ Present the freeway driver with only one decision at a time, and separate decisions by a reasonable distance to allow for adequate reaction time.

¶ Plan the turning movements so that they normally are made from the right lane, and require positive action by the driver.

¶ Present the motorist with consistent, familiar situations at points of decision.

Interchange Research Needed

R. L. Fisher, in a recent report to the Highway Research Board, points up the paucity of research work on interchanges. In his study for the New Jersey State Highway Department, Fisher attempted to evaluate


2" BIT. CONC. PROTECTIVE COURSE
4 PLY MEMBRANE WATERPROOFING
8" MIN. R/C ROOF SLAB
18'-0" DIAPHRAGM (TYPICAL)
FLUORESCENT FIXTURE
40' MIN
NORTHBOUND
SOUTHBOUND
4-1/4" X 4-1/4" CERAMIC TILE
8" CLASS 'C' CEMENT CONCRETE MASONRY WEARING SURFACE
3/4" ø TIE RODS
4 PLY MEMBRANE WATERPROOFING
4" CONC. BLOCK PROTECTIVE COURSE
2 ROWS OF BRICK IN MASTIC
4" CONC. PROTECTIVE COURSE
1 PLY MEMBRANE WATERPROOFING
1 LAYER BRICK IN MASTIC
6" CONC. MAT - CLASS 'D'
SAND & GRAVEL AS REQUIRED
EXCAVATE TO GOOD MATERIAL AS DIRECTED
DRAIN
ERECTION SHIM
NOTE
STRUCTURAL STEEL FRAMES ARE 5'-0" ON CENTERS

Fay, Spofford & Thorndike, Inc. designed this six-lane underground roadway, located on the Boston Central Artery.

Four level traffic interchange system on the Harbor Freeway is located close to the downtown Los Angeles area.

Traffic distribution structure for the San Francisco-Oakland Bay Bridge highway system is a marvel of engineering.

interchanges by accident record, operation, and capacity. Since even the most complicated intersection involves ramps with only three basic elements (entrance terminal, main section, and exit terminal,) the study centered around these areas.

Fifty New Jersey interchanges were studied over the past two years. Accident records were generally taken for the four year period from January 1, 1955 to January 1, 1959. Thus, most of the interchanges were designed at least 7 years ago. Some are 15 to 20 years old, and one has been in operation for over 30 years. The number of accidents at each interchange varied from 1 to over 130. If the latter figure seems large, it is only fair to point out that only two states have fatality rates lower than New Jersey. The older interchanges, with larger accident experience, were extremely helpful in determining the real cause of interchange accidents.

As a result of this study, New Jersey Engineers concluded that:

¶ There are no accidents that can be ascribed to curvature on inner loops which have a radius of over 100 feet. As ramps which have large radii take considerably more property and require more travel time, there appears to be no justification for one lane inner loops with a radius greater than 150 feet.

¶ When the main roadway has concrete pavement, black top acceleration and deceleration lanes do not receive full use. Most drivers cut over into the main roadway within the first 200 to 400 feet.

¶ Unless shoulders are provided, many drivers will use acceleration and deceleration lanes improperly.

¶ Adequate acceleration and deceleration lanes, careful treatment of terminals, and control of access can practically eliminate accidents at interchanges.

¶ All left hand entrances and exits in this study had poor accident records.

Digital Simulation Model Studies

One of the most promising developments in the design of highway interchanges is the general digital simulation model worked out by the Midwest Research Institute for the U. S. Department of Commerce. This simulation model, which can duplicate traffic flow on a 17,000-ft section of a freeway with two on-ramps and two off-ramps, can be used to evaluate a number of design criteria economically.

The basis for the simulation model is the statistical analysis of actual traffic data collected at freeway locations by the Bureau of Public Roads and the Texas Transportation Institute. Study of the collected data resulted in the development of the relationships between average velocity and total traffic volume, vehicle distribution to lanes and total

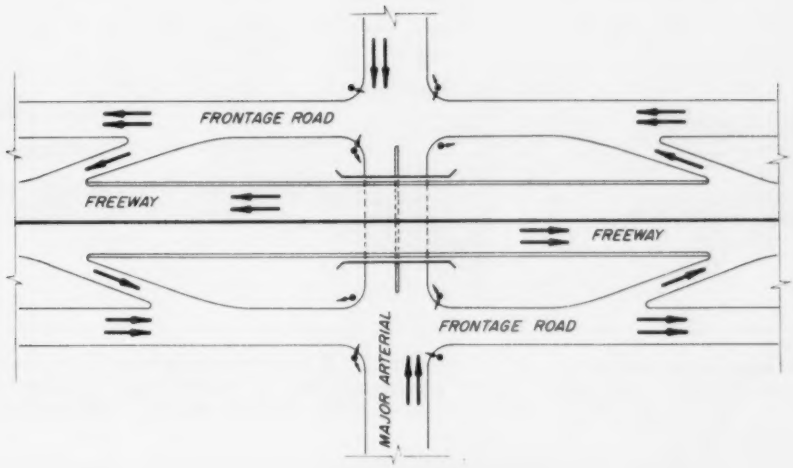
Jug handle design for right angled turns prevents the backup of traffic on this highway located in New Jersey.

Near perfect cloverleaf pattern where Route 38 passes under the Haddonfield-Sorrel Horse Road in Delaware Township, Camden County, New Jersey. The first full cloverleaf was constructed in 1928.

This cloverleaf is at Calhoun Street in Trenton, New Jersey, serving the Trenton East-West Freeway. It has been adapted to a site of relatively small area, but speed on loops must be slow, due to sharp curves.

Warren & Van Praag designed trumpet interchange on Illinois Toll Road.

Trumpet interchange on the New Jersey Turnpike. This design allows both entering and exiting traffic to be served economically by a single toll booth.

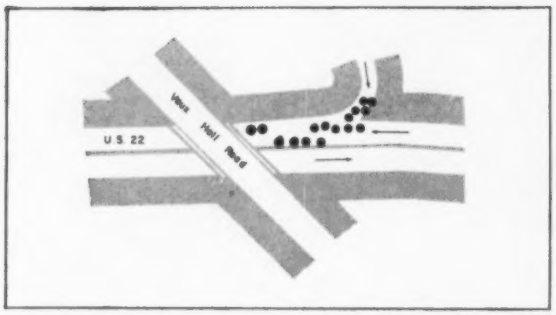


Diamond interchange can be used with or without frontage roads. It allows high speed exit and entry from and to a freeway, and can be designed so that land areas are less than required for cloverleaf.

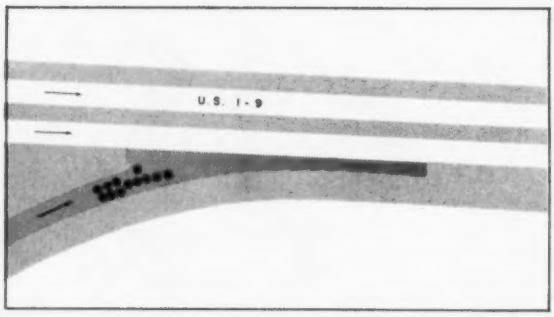
Britain's M-1 uses diamond interchange in combination with a standardized bridge. Note railroad underpass in immediate foreground.

M-1 flyover at junction with the Luton-Dunstable highway on the outskirts of Luton. This is typical interchange for the new motorway.

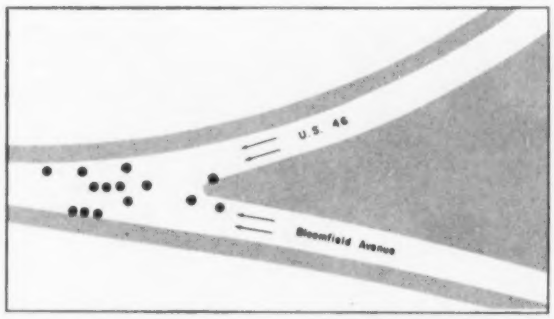
Here M-1 passes under the Dunstable-Newport Pagnell road, but interchange concept is identical to that shown in upper photograph.



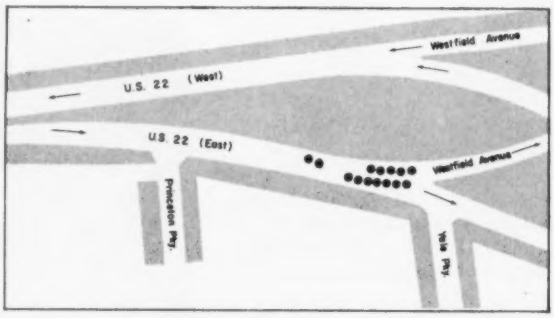
Accident pattern caused by tight radius on entrance ramps. Note that left hand curb on entrance ramp directs traffic to center lanes, cutting across the main traffic stream.



Even with 500-ft entrance radius and 300-ft long blacktop acceleration lane of parallel type, accident pattern develops on ramp, consisting mainly of rear end collisions.



Older type interchange with left hand entrance ramp has record of 14 accidents, 6 from merging, 4 from cut offs, and 4 from slowing down when merging with main stream.



There were 14 accidents for eastbound traffic at this intersection. Of these, 5 were caused when vehicles slowed to turn, 7 when vehicles tried to turn from the wrong lane.

traffic, and exiting vehicle distribution to lanes and distance from the off-ramp.

In the model studies, a simulated vehicle follows decision rules based on actual traffic data. The vehicle is allowed to maneuver through the section of the freeway under study, and such effects as changes in traffic volume, velocity, and freeway configuration then are evaluated by noting changes in the computer output of traverse time, waiting time on ramp, weaving complexity, and similar factors.

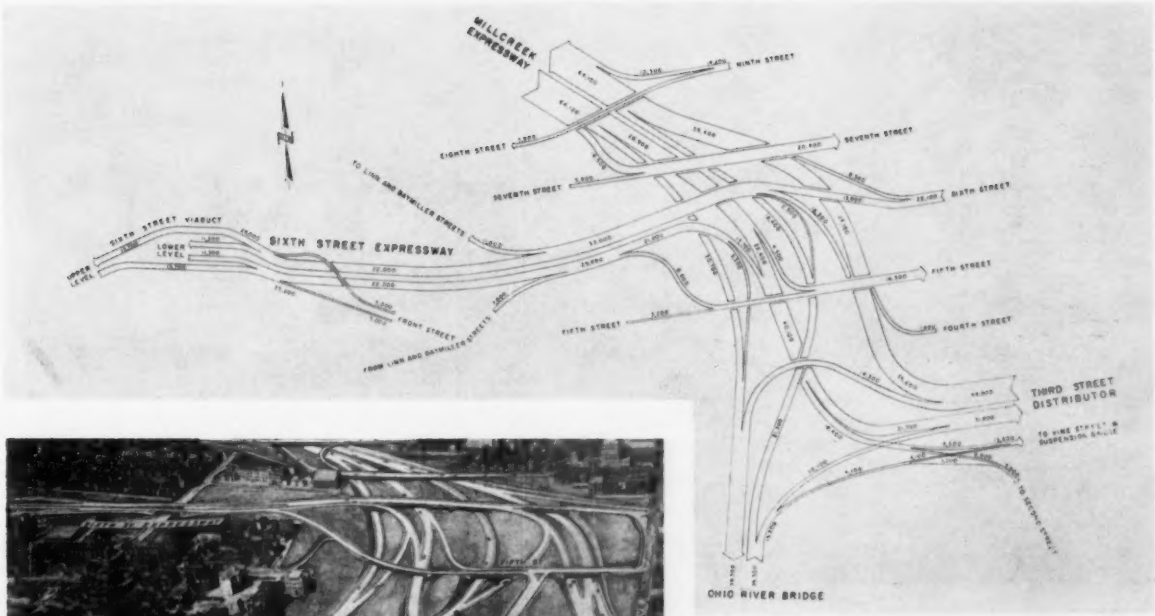
Controlled experiments were performed on an imaginary section of freeway 3500-ft long, containing one on-ramp and one off-ramp sequence. The ramps were located at two different positions in separate studies. The results of the experiments showed no significant difference between the traffic flow under the two different configurations for the traffic volumes used. However, at higher on-ramp volumes, one configuration ultimately may prove to be more satisfactory than others.

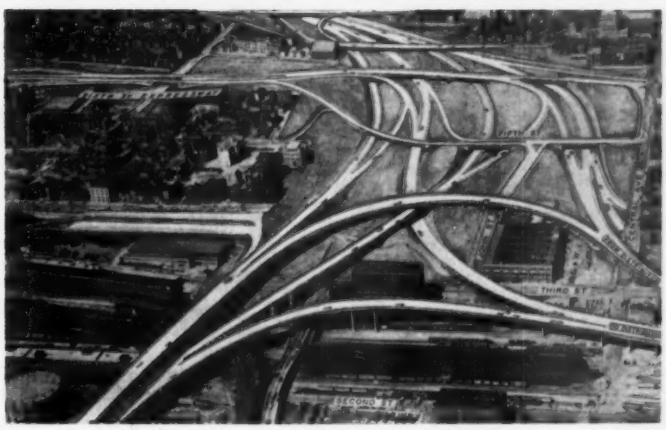
The computer simulation creates a duplication of the real situation at a small fraction of the cost of studying the real system. Further, it allows the evaluation of various freeway configurations without the expense of construction, and the performance of controlled experiments impossible with actual traffic.

San Mateo Interchange Study

While state highway departments frequently limit the ingenuity of the consulting engineer on interchange design, there have been many important projects on which the consultant has been given complete freedom. One of the most interesting recent studies in this area was done by Wilsey, Ham & Blair, for the County of San Mateo. The San Francisco Bay Area Rapid Transit District proposes to run rapid transit lines adjacent to the Southern Pacific Railroad facilities in San Mateo County for a total distance of about 20 miles.

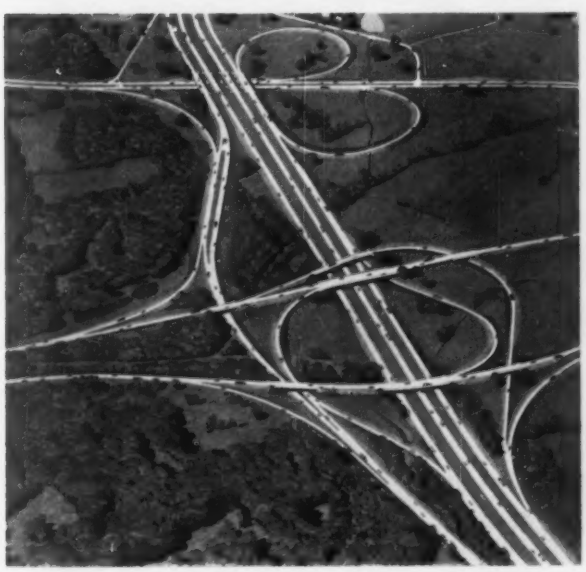
Of the many structures for which preliminary designs were made, the Hillsdale Boulevard grade separation was the most difficult. Studies indicated three almost insurmountable problems. The relative position of one road and the railroad-transit tracks appeared to be too close to permit a soundly engineered structure to be built, the commercial property west of that road seemed too valuable to be purchased and destroyed for right-of-way, and the high volumes



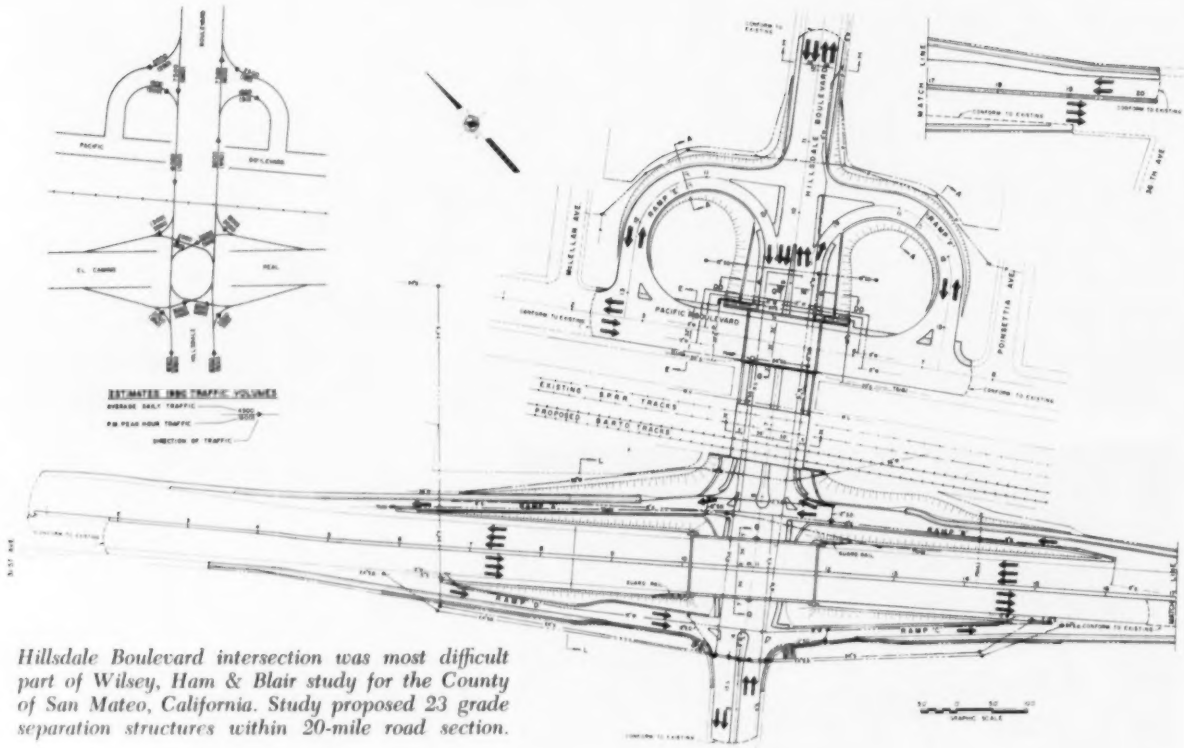


Hazelet & Erdal did the preliminary report and final design for Cincinnati's Mill Creek Expressway. Major construction contracts totaling $11.5 million have been awarded.

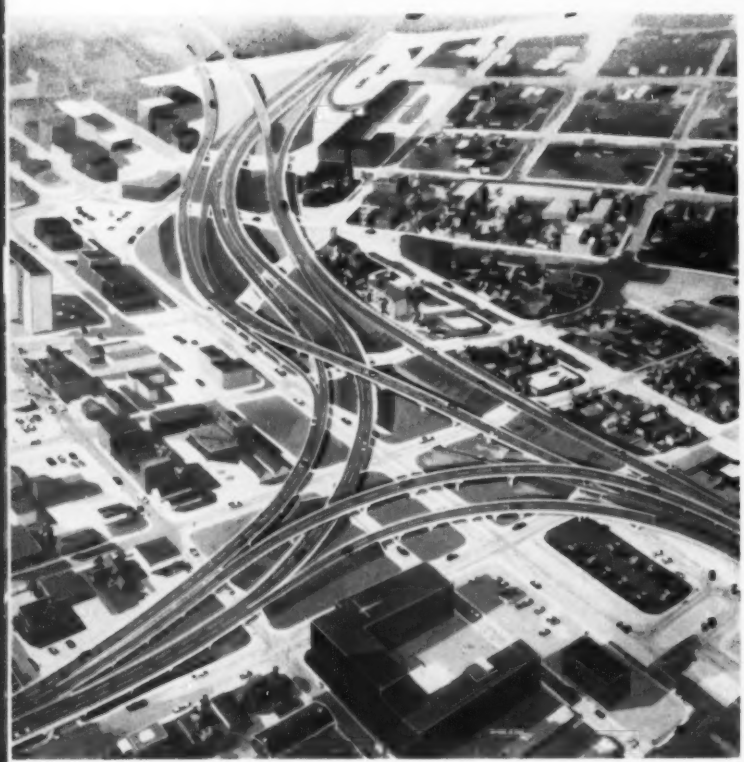
Ammann & Whitney designed dual access road for traffic between Washington and Dulles International Airport. The two interior roadways are accessible to express traffic only.



Kansas City's 6th Street Freeway, a depressed roadway, was designed by Howard, Needles, Tammen & Bergendoff.



Hillsdale Boulevard intersection was most difficult part of Wilsey, Ham & Blair study for the County of San Mateo, California. Study proposed 23 grade separation structures within 20-mile road section.



Goodkind & O'Dea are designing the Onandaga Interchange, the focal point for redevelopment of Syracuse.

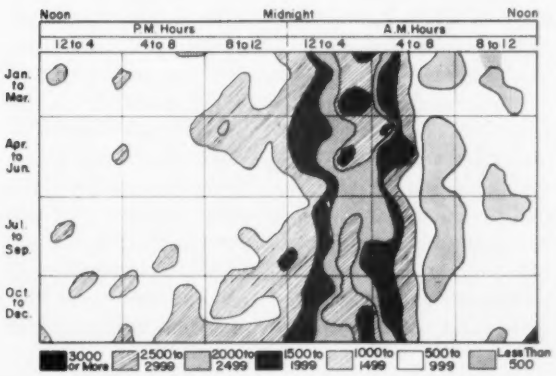
of traffic presented serious circulation and turning conflict problems.

In meetings with the State Division of Highways and the City Engineer and City Planner of San Mateo, many alternate plans were presented. The final design incorporated an undercrossing, primarily because it makes it possible to get back to grade in the shortest distance and because it is less obtrusive than an overcrossing.

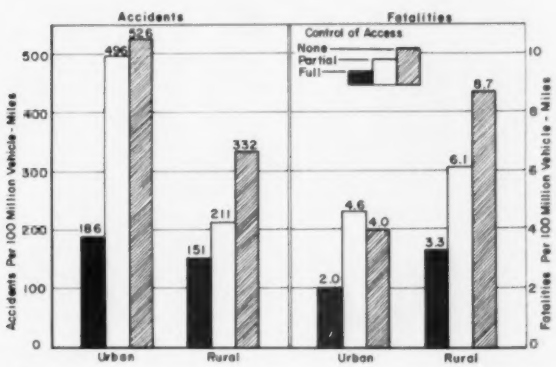
The final plan shown has two main points of traffic conflict in the left hand turning movements off and onto El Camino ramps. With coordinated three-phase signals at the intersections of these ramps and Hillsdale Boulevard, these traffic movements will function smoothly. El Camino traffic has been favored and will have no conflicts or stops, whereas, Hillsdale traffic will have only a minimum of hazard and delay and should operate efficiently at all times.

El Camino Real is shown with 6 lanes of traffic to meet the anticipated 1980 traffic load of 40,000 vehicles per day. Hillsdale Boulevard, with a predicted load of 18,000 vehicles daily will have four lanes, with six provided under the El Camino Real structure to facilitate weaving movements and storage for vehicles turning left. A two quadrant cloverleaf is planned for the Pacific-Hillsdale Boulevard intersection to reduce delay and congestion at that point. Estimated construction cost of the entire separation system is $2 million.

This California scene is typical of what motorists face all over the U. S. — a maze of signs fighting for driver attention.



Hour of day and month of year accident contours, Washington, D. C., for 1952. Accidents per 100 million miles.



Effect of control of access on accidents and fatalities on United States highways in both urban and rural areas.

Highways . . .

The Safety Factor

HIGHWAY SAFETY is traditionally the responsibility of state and local government. With few exceptions, the Federal government is confined to research, counsel, and encouragement. However, this does not mean that there is a lack of available standards. For example, the American Association of State Highway Officials, with the approval of the Bureau of Public Roads, has promulgated standards for traffic-control devices on the Interstate System which will be followed uniformly in every state. As research projects develop, safety factors, based on new and rapidly accumulating data, are being engineered into many of our modern roads.

Although true uniformity of traffic control devices has not yet been achieved, Wilbur Smith, of Wilbur S. Smith and Associates, points out that some traffic engineers are concerned with too rigid an adherence

Edge marking, with solid white lines, makes the scenic Maine Turnpike a safe road for high speed travel, night and day.

to standards already established. These engineers contend that rigid standards tend to dull efforts in the field of creative research. This is a basic dilemma in highway design, best illustrated by the recent hassle over the effectiveness of median barriers on the Pennsylvania Turnpike. But the fact remains that our highway death rate is appalling – particularly during the long holiday weekends.

Uniform Standards

The bible of U. S. exponents of uniform traffic control devices is the *Manual on Uniform Traffic Control Devices*, which has just been updated. The new standards were drafted by the National Joint Committee on Uniform Traffic Control Devices and approved by the member organizations: the AASHO, the Institute of Traffic Engineers, the National Committee on Uniform Traffic Laws and Ordinances, the American Municipal Association, and the National Association of County Officials. The last two organizations joined the National Joint Committee in 1960 and are expected to lend impetus to the modernization of traffic control devices throughout the nation. In May 1959, a Canadian joint committee on uniform traffic

Typical white-on-blue sign on Britain's M-1. Note "hard" shoulder which has been badly chewed up by heavy traffic.

Britain's first expressway sign illustrates principles laid down by Minister of Transport's special sign committee.

control devices approved more than 200 sign standards, as well as procedures for utilizing signals.

The Billboard Problem

There are many intangibles contributing to highway accident and death rates. For example, the problem of outdoor advertising signs often is approached solely from the standpoint of aesthetics. Yet there is some evidence that the billboard is a contributory cause of accidents. At the present time, adequate legislation has been passed by only six states for the control of outdoor advertising consonant with national standards, according to Clifton W. Enfield, of the Bureau of Public Roads. Two states, Maryland and Wisconsin, are taking advantage of the Federal incentive payments for billboard advertising control.

Edge Marking

Although almost unkown 10 years ago, edge marking is an important advance in highway safety for which values are measurable. In controlled tests by the Kansas State Highway Commission on similar sections of road, half edge marked and half not, the edge marking resulted in a 30 percent reduction in fatalities. A recent study indicates that all but eight states now are using this device. North Carolina leads with 16,000 miles of edge marked highways.

Traffic Pacer System Shows Promise

Early this year, the Macomb County (Michigan) Road Commission and General Motors Research Laboratories announced the installation of a four-mile "Traffic Pacer" system. This unit is based on the German version of a traffic funnel, developed by Dr. Wolfgang von Stein and now being used extensively in Dusseldorf and Cologne. The system is designed to separate steady traffic flow into groups of cars, timed to arrive at intersections during the green signal interval. This is accomplished by an illuminated speed sign, situated just beyond each intersection, that advises the motorist how fast he should drive to make the next green light. The indicated speed varies according to the position of the car in the group or its time of passing the sign. Even during heavy traffic periods, large capacity increases can be achieved by setting low speeds and allowing cars to travel closer together. German experience indicates a 20 percent increase in traffic handling capacity, fewer stops for motorists, and increased safety.

Britain's Freeway Sign Standards

Signs on British motorways offer an interesting case history of progress. When the country's first motorway (M-1) was in plan, the Minister of Transport appointed a special committee to advise him on the subject. Its chairman was a leading ship owner! The committee first studied highway sign practice in the U. S. and on the continent of Europe, and then set up practical demonstrations of experimental signs on an abandoned airfield near London.

It was recognized that signs would have to be readable at speeds of 70 mph and above, without the driver having to divert his gaze through an angle of more than 10 to 15 degrees. Legibility at 600 feet was thus required, and lower case letters, at least 12-in. high, were established as standard. The use of lower case letters with initial capitals was chosen because of the distinctive shape that words acquire when lower case letters are used.

Experiments soon indicated that light letters on a dark background were more legible than dark on light, particularly at night. Blue was chosen as

Typical overhead signing as used on the California freeway system. Note guywires for combination standards.

Rigid sign supports at urban interchange area on Interstate Route 85, as it bypasses Charlotte, North Carolina.

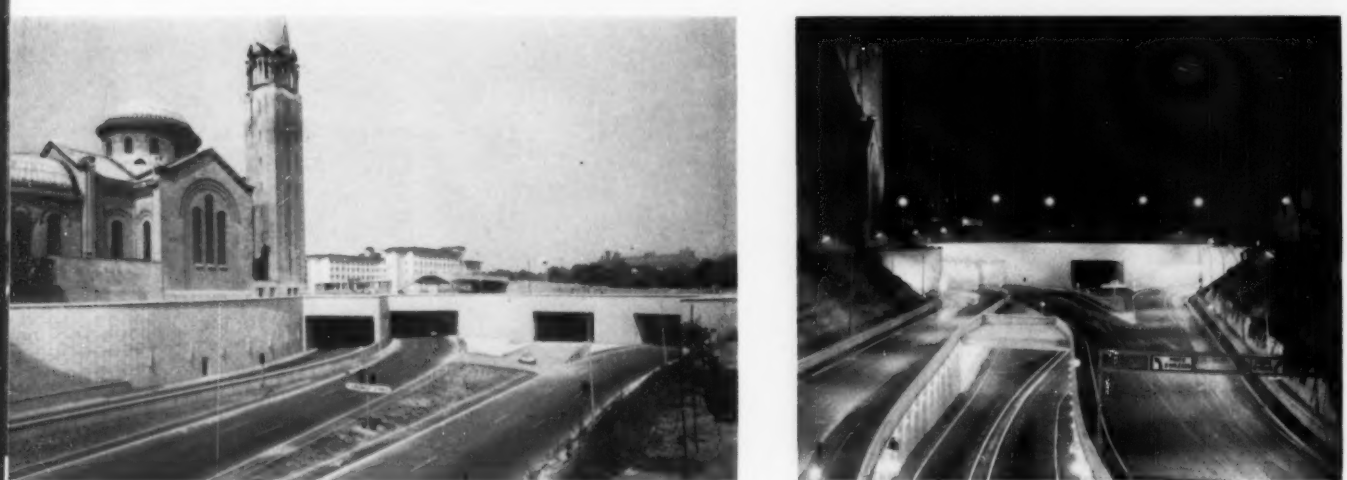
Day and night scenes show effectiveness of new type reflectors used on Autobahn signs at an interchange near Cologne.

a background color with white lettering — in conformity with European practice. External lighting was recommended, but where impractical, reflecting material was allowed.

Recognizing that direction signs on a motorway must be provided well in advance of the exits, and that they must be repeated because traffic might block the first one from a driver's view, it was decided to use three signs for each exit. The first, consisting of a junction symbol, the route number of the connecting road, and the distance to the exit, is set one mile from the turn. The second sign, a half mile before the turn, repeats this information and includes the names of places that can be reached by leaving the motorway. The third sign repeats all previous information and adds the forward destination of the motorway. A final repetition of the message is given by a flag type sign at the point where the exit road diverges from the motorway. Exit distance markers in advance of deceleration lanes take the form of diagonal white bars on a blue background, three for 900 feet, two for 600 feet, and one for 300 feet.

Highway Lighting

Lighting for streets and highways with uncontrolled access has been widely accepted, as the result of



Effective lighting on the Paris Expressway multilevel connecting link with the City of Paris Circumferential Boulevard.

Lighting standards are mounted on the median strip on U.S. 287, at the northern limits of the city of Rawlins, Wyoming.

studies clearly proving its value in terms of human life and property. On the thruways, it is another matter. Here there are no pedestrians, no cross traffic, and, except in urban areas, few distractions. Continuous freeway lighting is estimated to cost from $50,000 to $60,000 per mile for four to six lane roads. Energy and maintenance add another $3000 to $7000 per mile annually. Thus, though the picture may change, there is little demand for freeway lighting except at interchanges and in urban areas where adjacent light sources may cause driver confusion.

The whole subject of freeway lighting is open to basic research. For example, there have been instances where the lighting standards themselves caused severe accidents when hit by cars leaving through lanes. On the other hand, lighting at interchanges in rural areas offers a target that is visible to drivers at great distances, helping them to gauge their exit speed more accurately. The placement of lights at selected points also introduces the problem of designing adaptation lighting to allow drivers to make a safe transition from light to dark zones. Thus, it is evident that existing highway lighting is based on engineering judgment rather than adherence to accepted rules.

Guard Rails and Barriers

Roadside guard rails and median barriers have been the subject of much investigation. Again, there is no agreement among highway engineers as to whether they are a boon or a bane to motorists. A roadside

Colorado's Pueblo Expressway uses median barriers and night lighting near the largest steel plant in the west.

Prestressed concrete shell supports aluminum alloy louvers to provide safe transition lighting at underpass near Paris.

Dual safety median barriers and lighting standards are incorporated in center strip of France's new freeway near Arcueil.

guard rail must have a beginning, and hence it offers a ready made obstacle for the motorist who is forced off the highway. Various attempts have been made to solve this problem, but they have been neither easy nor economical. The same is true of the median barrier. Where opposing traffic lanes are close together, the median barrier eliminates the possibility of a head-on collision, but at the same time, it can throw a car back into an adjacent lane of traffic and cause a multicar accident. There is not enough research to give positive and simple answers to the question of when and when not to use these devices.

Two strands of steel cable plus chain link fence form median barrier being used on the California freeways.

Highway Landscaping

The landscaping design factors in highway safety are rapidly coming under the scrutiny of our highway engineers. However, it is interesting to note that many a young tree gracing the right-of-way of our highways will kill a motorist in not too many years.

Nevertheless, there is every reason to believe that proper plantings of trees and shrubs along our highways not only can create and preserve natural beauty, but also can serve to create better highways. Erosion control, snow control, reduction of glare, control of noise and exhaust fumes, indication of curves, and screening of distracting traffic movements are some of the benefits of highway landscaping.

Naturally, one of the most important contributions to safety is the broad highway with gentle slopes protected from erosion by good stands of grass. When this space is available at reasonable cost, wide medians are also possible, and these can be planted to reduce glare and distraction from opposing traffic lanes. There is sound evidence that this adds interest to motoring and reduces driver fatigue resulting from high speed travel. ▲▲

This article is based on a chapter from *The Consulting Engineer*, by C. Maxwell Stanley. The book will be published by John Wiley & Sons, Inc., of New York City.

Business Organization For Consultant's

C. MAXWELL STANLEY
Stanley Engineering Company

THREE ALTERNATIVE FORMS of organization are available to the consulting engineer in the United States: an individual proprietorship, a partnership with one or more partners, and a corporation. Selection of one of these alternatives depends upon many professional, practical, and legal factors. For a full understanding of the legal problems, the consulting engineer should retain competent legal counsel. Such assistance is needed both to select the proper form of organization and to prepare the necessary legal documents which every business requires.

Individual Proprietorship

The individual proprietorship, sometimes called sole ownership, is the simplest business entity. One individual owns and operates the business and provides the required capital. All property and equipment are owned personally by him. The owner normally manages the practice, although he may employ a manager. However, all contracts are made in his name, and he is personally responsible. As an individual proprietor, he is personally liable for all debts, obligations, and responsibilities of the business. This personal liability extends to all assets he owns, even though they are not used in the consulting practice. The individual proprietor must pay income tax each year on the entire earnings of the business. Such earnings are added to his income from other sources, and the tax is computed on the whole.

This is an easy way to begin the practice of consulting engineering. An individual simply hangs out his shingle and starts to practice. No legal procedures are required to put him into business, except registration as a professional engineer.

The advantages of an individual proprietorship for the practice of consulting engineering are:

¶ Organization is simple and no involved legal procedures are needed.
¶ Practice is legal in every state of the United States.
¶ Management is immediate and direct, for the owner makes all decisions himself.
¶ Direct personal professional responsibility is maintained with the clients.

The disadvantages of the individual proprietorship for consultants include:

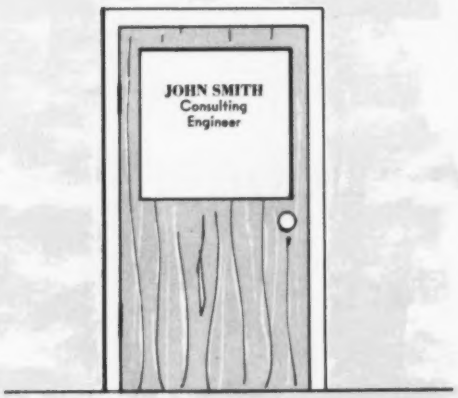
¶ Inability to share decisions and responsibilities.
¶ Absence of continuity in case of death or extended illness of the owner.
¶ Personal liability of the owner for all acts of the organization. Any or all of his assets or property may be attached for debts or judgments.
¶ Difficulty of arranging deferred compensation or retirement for owner.
¶ Necessity of paying taxes on full earnings annually, even though earnings are not withdrawn.

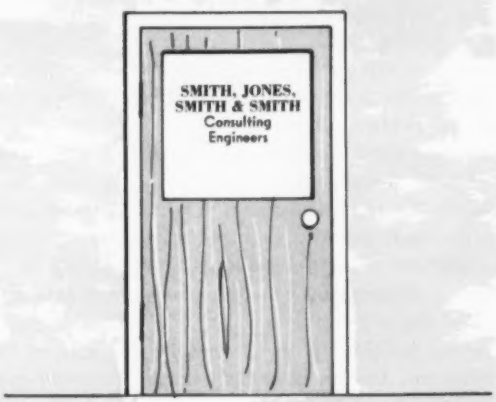
There is a distinct place in the consulting engineering field for the individual proprietorship, which serves adequately for most one-man or small organizations. The inadequacies of the individual proprietorship become evident when there is a desire for more than one owner or when the practice is successful and grows to a substantial size.

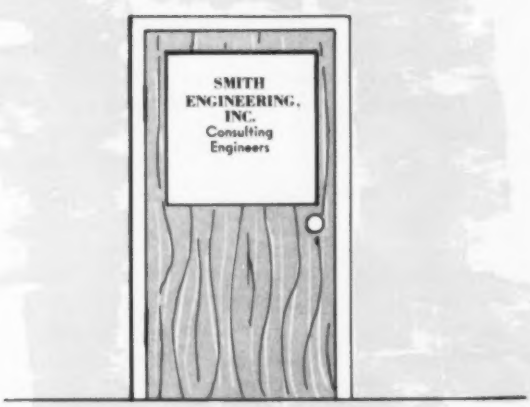
Partnerships

Next to the individual proprietorship, the partnership is most favored by consulting engineers because it allows multiple ownership while retaining the personal touch of the owner-managers.

State laws regarding partnerships vary, but basic features are similar in all states. Two or more persons form a partnership, and their relationship is usually expressed in a written partnership agreement. They







contribute capital, share earnings, and assign management responsibilities on any agreed basis. In most small partnerships, the management responsibilities are divided among the partners. However, management responsibilities may be delegated to an employee or to one of the partners.

Earnings of the partnership are divided annually according to predetermined ratios established by the partnership agreement. Partners may receive drawing accounts against expected earnings, or salaries that are classified as operating expenses in determining partnership earnings. Each year the partnership must file tax returns showing the profit or loss, prorated to the partners. Each partner must pay annual income tax on his share of earnings plus any salary received from the partnership, even though the earnings are not withdrawn. Each partner must add partnership earnings to his salary and other income, and compute the tax on the whole.

Partnerships have several distinct advantages for consultants, including:

¶ Provision of a simple means of multiple ownership.

¶ Legality to practice engineering in all states of the union, if partners are registered professional engineers.

¶ Close personal professional touch of the owner-managers with the clients.

On the other hand, partnerships have certain disadvantages, including:

¶ Personal liability for all debts and actions of the partnership even though incurred by the individual acts of other partners.

¶ Lack of continuity, as partnerships usually end with the death or withdrawal of a partner.

¶ Liability of a partner's interest for his personal debts or obligations arising from nonbusiness activities of other partners.

¶ Difficulty of reaching management decisions that normally require unanimous agreement of partners.

¶ Inability to arrange key personnel ownership participation except by increasing the number of partners, perhaps to an unwieldy level.

¶ Difficulty of arranging for deferred compensation or retirement programs for owners.

¶ Necessity of paying taxes on full earnings annually, even though earnings are not withdrawn.

The advantages of the partnership are such as to make it attractive to consulting firms with multiple ownership. Its disadvantages become obvious as the size of the practice grows and as financial resources and responsibilities increase.

There are ways to offset partially several of the inherent disadvantages of partnerships. Partnership agreements can be drawn to provide for continuity in case of death or withdrawal of a partner. The remaining partners may be given options to purchase the interest of the deceased or withdrawing partner. Partnership agreements also may be arranged to

simplify management decisions, perhaps allowing majority decision. Insurance can be carried to lessen financial hazards, including those arising as a result of errors or omissions.

Limited partnership statutes have now been passed in every state, making possible the addition of investing partners who do not participate in the management of the partnership and who have liability which is limited by the amount of their investment. However, the general, or managing partners still have unlimited liability.

Corporations

A corporation is the alternate to a partnership when multiple ownership is desired. A corporation is an intangible "being" endowed by law with certain powers to transact business.

Although the features of state corporate laws are not identical, the basic pattern for corporations is similar. Ownership in a corporation is represented by stock. Various kinds of stock may be issued, but usually the common stock has the voting power. Control of the corporation is vested in the stockholders, a majority of whom can influence basic decisions. Individual stockholders have no personal liability for the debts or obligations of the corporation.

The stockholders select a board of directors at annual meetings. The authority of directors varies but normally includes the election of officers to manage the corporation and the establishment of broad policies. The officers of a corporation usually include a chairman of the board, a president, one or more vice presidents, a secretary, a treasurer, and perhaps others. They are invested by the bylaws of the corporation and by the action of the board with certain administrative and executive responsibilities and authorities.

The formation of a corporation requires a charter from the state. It usually requires publication of certain notices. The organization of a corporation is a moderately complicated procedure requiring competent legal guidance.

Each year corporations pay taxes on earnings on a graduated scale. Net earnings of the corporation may be distributed to stockholders as dividends. Individual stockholders pay no personal tax on corporate earnings except as they receive dividends from the corporation. Owner-managers of small corporations usually function as officers and receive salaries. These salaries are considered as corporate expense in determining net corporate income.

Some advantages of a corporation are:

¶ Avoidance of personal financial liability and responsibility for the debts and obligations of the business.

¶ Continuity of the firm in the case of death or retirement of an owner.

¶ Management is simplified, being vested in the officers and in the board of directors, which may act by majority decision.

¶ Easy provision for multiple ownership.

¶ Stockholders pay taxes only on dividends or salaries which they actually receive.

¶ Establishment of retirement or deferred payment programs for owners is simplified.

Some disadvantages of the corporation are:

¶ It may not legally practice professional engineering in some states. (New York and Ohio now specifically prohibit corporate practice. In a few other states the right is doubtful, and in several states there are some restrictions on corporate practice.)

¶ The direct personal professional responsibility of owner-manager is more difficult to maintain.

The corporate form of organization offers significant advantages to large practices where there are a number of owners. Hence, in spite of precedent and opposition, there has been an increasing trend toward corporate organization in recent years, and there is every indication that it will continue.

Taxes

All businesses, whether sole ownerships, patrnerships, or corporations, are subject to federal income taxes. Moreover, in certain states they are subject to state income taxes.

The relative tax benefits of sole ownership, partnership, and corporation are too complicated to permit general conclusions. This is due partly to the ever-changing tax statutes and laws enacted by the United States and by the various states. It is also due to variations in rates of state income taxes. Moreover, the relative income tax for different forms of organization may change appreciably at various levels of income and with various situations of personal income from other sources.

To determine relative tax advantages, a careful analysis is needed for each situation. Frequently this calls for the help and guidance of an experienced accountant or tax expert.

With an individual proprietorship, the owner is taxed each year on the total net earnings of his business, plus his income from other sources. With a partnership, each partner is similarly taxed on his share of the total net earnings, since the partnership pays no tax. Each partner must add partnership earnings to other income to determine tax liability. Therefore, in the case of a sole ownership or a partnership, the amount of tax is the same for a given income of the proprietor or partner.

With a corporation, however, the tax determination is far more complex because of the many alternatives with respect to salaries, bonuses, and dividends. Currently the federal income tax is on a graduated percentage, increasing with total income due to a two-part tax consisting of a normal and a surcharge rate.

Stockholders of a corporation, however, pay tax only upon amounts received from the corporation as salary, bonus, or dividends. A nominal dividend credit is currently permitted in computing federal income tax.

The determination of the relative tax cost with a corporation requires a careful comparison of both corporate and individual taxes under the two arrangements. United States legislation now permits a corporation to be taxed as a partnership if the number of stockholders is ten or less. Under such circumstances, the income taxes under corporate operation are the same as under partnership operation. Corporations may make such a decision only once and cannot easily go back to corporate taxation should it later appear desirable. If this option to be taxed as a partnership is not elected, corporation taxes may be minimized by paying higher salaries and bonuses to officers and stockholders. Such salaries and bonuses are considered operating expenses in determining the net profit of the corporation. Thus, the tax paid by the corporation is reduced, but the owners are taxed on higher incomes. The levels of salaries and bonuses are subject to scrutiny by the Bureau of Internal Revenue and are subject to proof of their reasonableness.

Another tax advantage may be gained with a corporation if the owners establish a deferred compensation or retirement program for themselves. If this is done, the corporation treats the payments for such a program as an expense. However, the beneficiaries are not taxed until they receive the money, usually after retirement, when other income is lower.

With all of the variations mentioned above, it is evident that no simple rule of thumb can indicate the relative tax differences for a corporation, as compared to a sole ownership or partnership. It is necessary that a careful analysis be made in each situation.

Individual Proprietorship versus Corporation

So long as a practice is owned by one individual, the only choices he has are an individual proprietorship or a corporation. If he chooses the latter, he is required, in some states, to have other qualifying stockholders. This requirement is often met by having a few qualifying shares held by others, perhaps his wife, attorney, a close relative, or an employee.

The individual proprietorship has many advantages for the small practice with one owner. It avoids legal formalities, it allows practice anywhere, and it maintains personal professional responsibility. The hazard of personal liability can be minimized by adequate insurance, including an errors and omissions policy. Pressure for employee retirement programs is not great, since there is usually a small staff. Bonus or profit sharing programs can provide desired incentive compensation. The owner of a small practice, therefore, is not likely to consider corporate organization unless it offers some distinct tax advantages, perhaps related to a deferred compensation or retirement program which he may wish to establish for himself.

A corporation also may offer tax advantage if the owner desires to leave a substantial portion of the profits in the business. Depending upon his incremental income tax rate, he may be ahead by reducing his personal income and paying only the corporate tax upon the profits left in the business. A corporation also may be considered if the individual proprietorship develops into a large organization where the owner must delegate considerable authority to employees. Then he may desire incorporation to protect his personal investments and property not involved in the practice.

Individual Proprietorship versus Partnership

There is no reason to consider a partnership unless multiple ownership is desired. The need for multiple ownership arises from a number of sources. More than one owner may be desirable to bring technical ability into the organization, to share management and sales responsibilities, or to provide capital. Sometimes the desire for continuity prompts an established sole owner to take a younger partner into the firm who can carry on after his retirement. Once multiple ownership is elected, the organizational alternatives are the partnership or corporation.

Partnership versus Corporation

From a strictly business point of view, the corporation has many advantages over a partnership. Its principal disadvantage, in the past, has been the tax situation, which, at best, has been complicated and, at worst, has resulted in excessive double taxation. Now, however, corporations with less than ten stockholders have the option to be taxed as partnerships. Thus, the tax objection to the corporation is removed for consulting engineering firms falling within this limit. For firms with more than ten owners, tax matters require careful analysis to determine relative costs. There are numerous options with respect to salaries, bonuses, dividends, and deferred compensation, which may permit a more favorable over-all tax situation with the corporation than with a partnership.

So far as management is concerned, the corporation permits majority decision and more direct assignment of responsibility and authority. The corporation gives protection against personal liability, allows continuity of the organization, and simplifies deferred compensation or retirement programs for the owners.

The disadvantages of the corporation are related to professional matters. It cannot practice consulting engineering in certain states, and it makes personal professional responsibility more difficult. These disadvantages no doubt have limited the number of practices turning to corporate organizations. Nevertheless, as a practice grows, the advantages of a

corporation become more apparent. Higher capital requirements increase the hazards of personal financial liability to partners and make the corporation attractive. Furthermore, in a corporate organization a larger number of employees may participate in ownership. Fifteen or twenty partners may create a difficult management situation, but the same number of stockholders can function under a corporate structure in complete harmony.

The principal reason for incorporation, however, is the financial advantage to owners and their estates under our present high personal and inheritance tax laws. Corporate organization permits owners to take advantage of deferred compensation and retirement programs for themselves. It also helps to assure continuity of the organization beyond their death, thus making it easier for their heirs to recover the investment in the practice. Such benefits, rather than any desire to avoid personal professional responsibility, cause the present trend toward corporate structure for consulting engineers. Although this trend is most noticeable among large, mature practices, many new organizations, realizing the long-term advantages, are adopting the corporate structure.

Professional Responsibility

With increased use of corporations in consulting engineering, the serious problem of maintaining professional responsibility is raised. This problem needs careful attention lest professional standards be lowered. Much of the controversy that has raged over corporate practice has centered on this problem. Most of those who object to corporate practice argue that personal professional responsibility will be lost. They raise the specter of corporations dominated by non-engineers without professional interest practicing as consulting engineers. Many of the violent opponents of corporate practice are consultants with small organizations, whose needs are adequately met by individual proprietorships or partnerships. Little opposition comes from consulting engineers who, through experience with large practices, have become aware of the weaknesses of partnerships.

Nevertheless, care should be exercised to prevent corporate practice from weakening professional responsibility. It is very important for consulting engineers who choose to operate as corporations to take precautions to maintain high professional standards. It is also important for professional organizations of consulting engineers to focus attention on this need.

No responsible consulting engineer should condone practice by a corporation unless it is controlled by professional engineers and unless engineering work is done by professional engineers. One way to help assure this is to strengthen state laws relating to professional engineers. The laws of some states that permit corporate practice now require all officers to be registered professional engineers. This wise limitation should, in my opinion, be embodied in all registration laws. Moreover, I believe the majority of stock in any corporation that offers consulting engineering services should be held by registered professional engineers who are active in the management of the corporation.

Certainly state registration laws should be modified to remove from those corporations practicing consulting engineering any exemptions from registration now permitted to business and industrial corporations. These latter organizations may not be required to use professional engineers in the design of improvements or products for their own use. No such exemption should be extended to a corporation that offers its services to the public as consulting engineers. In addition to tightening registration laws regarding corporate practice, many of the same restrictions should be included in the charter and bylaws of corporations organized to practice consulting engineering.

Personal Preference

Having had experience as a consulting engineer with each of the three forms of organization, I offer the following personal opinions regarding selection of a legal entity.

If I were the sole owner of a small or moderate sized practice, I would operate as an individual proprietor. If I were involved in multiple ownership with two or three other individuals, I would prefer a partnership until the size of the organization became such that there were substantial advantages in corporate organization.

Having reached that point, I would change to a corporate organization, with the following restrictions written into the charter and bylaws:

¶ Ownership of stock should be limited to professional engineers active in the organization with, however, a reasonable time for disposal of stock by the estate of a deceased stockholder.

¶ Options should be established permitting other stockholders to acquire the holdings of deceased or retired shareholders on a predetermined basis.

¶ Officers of the corporation should be limited to registered professional engineers.

¶ The intent of the registration laws should be respected and professional engineers used to carry all engineering responsibilities.

If projects were to be handled in states prohibiting corporate practice, such contracts could be taken either by individual officers or by a partnership of principal officers.

With such precautions and restrictions, a corporate organization can maintain the personal professional responsibility required by the private practice of engineering. ▲▲

AE The Consultant's Role

Philip Will's article, "Bringing the Design Professions Together," inspired this commentary on the changing role of the consultant.

WHEN AIA PRESIDENT Philip Will, Jr. wrote of his aspirations for improving the professional relationship between architects and consulting engineers (CONSULTING ENGINEER, January 1961), he set a goal for both professions to achieve a degree of success and satisfaction in their association as building designers that would be new and unique in our lifetime. He has done a commendable service to consulting engineers and architects alike in recognizing the great complexity of modern buildings and defining so explicitly the different and necessary functions of the two professions. It is to be hoped that the inclusion of engineers as equal members of the design team, rather than as advisors, is a plan for better things in the future for both professions.

CE exclusive

Admittedly, the expression "design team" is still new. It is not commonly understood by the general public, and unfortunately, it is not even accepted as a reality by members of both professions. The fault can be shared equally by architects and engineers. Architects still are reluctant to acknowledge publicly the engineers' contributions to building design. Engineers still seem unable or unwilling to participate wholeheartedly in a project from its conception to its successful completion.

For many hundreds of years the architect has been considered master of all arts and sciences associated with buildings. In a large sense this has been historically true in terms of the monumental and ornamental structures that preceded the skyscraper and the large functional buildings of today. Before the transition, beginning in about the year 1885, the architect was truly both architect and engineer. With the limited engineering knowledge available at the time, most of which was empirical, he was reasonably successful in his design work.

Now the demands for taller and larger structures, for better utilization of space, and for more comfort and convenience in the enclosed environment, present problems of such great magnitude that only the rare and gifted mind could comprehend and utilize the full knowledge of buildings that has been developed. Mechanical, electrical, and structural engineering have made tremendous advances in this century, and engineering progress alone has made the skyscraper possible. Today, the architect's imagination in creating a functional enclosure is limited only by the ability of engineering technique to make it a practical reality.

Despite this, many consulting engineers are content to accept the position of adviser rather than co-designer or member of the design team. Therein lies the fault. Traditionally, engineers have felt that they are more men of science than professional men rendering a public service. They have become satisfied with personal accomplishments rather than public recognition. In short, engineers have been sadly deficient in one very important phase of their development – professionalism.

The first move to correct this situation is up to the consulting engineers practicing today, particular-

on the Design Team

HARRY J. SCHARRES
E. R. Gritschke & Associates

ly the old timers with established reputations. They must adopt a standard of practice and institute a plan for betterment of the profession. This new plan would have to be subscribed to by all consulting engineers in order to present a common front in moving forward to a better and more rewarding practice.

In my opinion, in addition to the fundamental requisite of technical competence, the consulting engineer must develop three basic qualities:

¶ Personal and professional integrity. These are of paramount importance. Without integrity there is no profession, nor is there self-respect as an engineer.

¶ Business and organizational ability. These are equal in importance to engineering proficiency. Engineers by nature are inclined to believe that outstanding engineering work alone will gain them recognition and profit. This misconception is probably the major cause of failures among engineering firms. It is necessary that problems in business be dealt with in the same professional manner as engineering problems. Even the smallest organization must either develop professional accounting and organizational methods or secure outside assistance. It is usually best if the business management personnel are not distracted by engineering problems, and without question, an engineer should not be required to divide his time between his engineering work and the details of running the business.

¶ Salesmanship. It cannot be said that salesmanship is equal in importance to integrity and business ability, because a firm can exist on these qualities alone. However, salesmanship can make the difference between a mediocre and an affluent practice. The consulting engineer must learn to sell himself, his ability, his service, and his integrity — in a most subtle manner. A successful client-engineer relationship depends to a large degree upon the client's confidence in the engineer. Client confidence is satisfaction regardless of profit, and it must be sold.

There is another course of action for betterment of the profession that can be pursued along with this plan for personal development. That is to take up the challenge and truly become a member of the design team. Then all team members will begin the project together, see it through to successful completion, and share, to the extent of their contribution, in the final reward. Specifically, the engineer must:

¶ Participate along with the architect in the initial client conferences, prepare a program, and formulate the basic engineering design.

¶ Produce working drawings in cooperation with all other members of the team.

¶ Diligently maintain an atmosphere of mutual respect and assistance among the specialists involved in the production of working drawings.

¶ Assist in the final negotiations and execution of the contract for construction.

¶ Supervise the construction to whatever degree is necessary to protect the client's interest and assure completion of the contract.

¶ Assist in putting the building in operation to perform its function.

¶ Instruct and guide the owner in the proper operating and maintenance procedures until he is fully capable of assuming this responsibility for himself.

¶ Always be available to advise or assist a client in coping with changing requirements for building use.

I believe all consulting engineers will subscribe wholeheartedly to this plan with only one reservation — it also must be accepted by the architects. If we can conclude that all consulting engineers will accept the challenge, it remains for the AIA officially, and each architect individually, to accept this agreement and make it economicaly feasible and professionally practicable.

The development of the professions of architecture and engineering are approaching a very critical period. We can agree to move ahead cooperatively for our mutual benefit, or we can remain in conflict until one wins out over the other. To quote an old master of building design, Louis Sullivan, ". . . both professions contained small and large minds — mostly small or medium". Great things will be done in the future, and it is imperative that the best minds in both professions meet in an atmosphere of mutual respect and cooperation for the betterment of the art of building design and for the advancement of their own professional status. ▲▲

J-94157-1

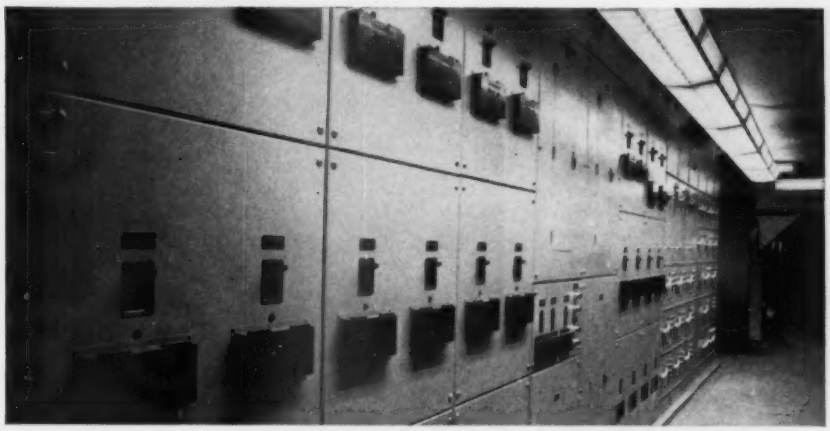
WESTERN-SOUTHERN LIFE GROWTH SPECTACULAR... THEY POWER-UP WITH WESTINGHOUSE

In 1888, The Western and Southern Life Insurance Company issued 11 policies in its first week. Today: six million, five hundred thousand policies in force. Assets and insurance-in-force increased more in the past three years than in the first 45. Result: based on assets, the company is now the nation's 18th largest.

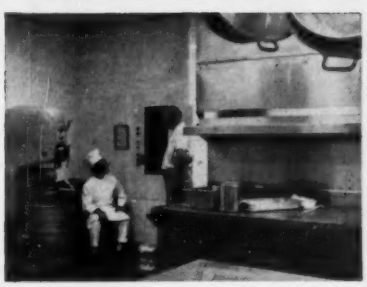
Growth of Western-Southern Life's Cincinnati headquarters has been spectacular. In 1916, the first headquarters building was erected. Additions followed in 1923, '35 and '52. In 1958, a seven-story main building (above) approximating 142,000 square feet provided a major expansion in the company's administration quarters. Now under way: another seven-story structure, slightly larger, to bring total headquarters square footage to 600,000. Forming the power backbone for Western-Southern Life's fast, efficient service to policyholders is coordinated Westinghouse equipment throughout the headquarters complex. For more details, turn the page.

Westinghouse switchboard and control center handle all light and power requirements except refrigeration for Western-Southern Life's main building (at left). Westinghouse Tri-Pac* De-ion® circuit breakers were specified to protect against high fault currents. They provide current limiting protection in addition to time delay thermal trip, instantaneous magnetic trip.

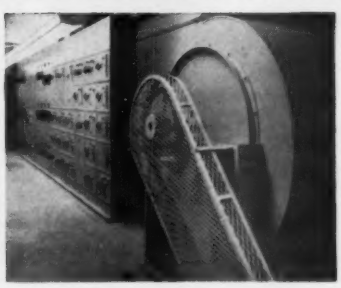
*Trade-Mark



Team responsible for newest headquarters building examines model of computer system to be housed in building. Left to right: Harry Hake III, Associate Architect, Harry Hake and Harry Hake, Jr.; H. C. Mode, Vice President, Turner Construction; William C. Safford, President, Western-Southern Life; Frank Niemer, Home Office Buildings Manager, Western-Southern Life; E. C. Baur, President, Baur Electric; C. W. Benz, Westinghouse Area Manager; and O. W. Motz, O. W. Motz and Associates. J-94157-2



Complimentary meals for 2400 headquarters employes are prepared in this gleaming kitchen. Chef Anton Berta and Fred Welage, Baur Electric Superintendent, discuss convenient CDP distribution panelboard controlling kitchen electrical circuits.



One of quiet, efficient centrifugal fans in air handling system. Unit is exclusive Westinghouse Airfoil blade design. Built by Sturtevant Division, it returns 13,500 cubic feet of air per minute from the cafeteria air conditioning system.

Trade-Mark

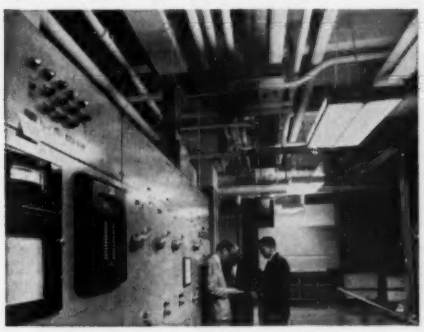
Westinghouse

WESTINGHOUSE HELPS WESTERN-SOUTHERN LIFE KEEP PACE, ELECTRICALLY, DURING NINEFOLD LOAD GROWTH

Messrs. Nagel, Baur and W. B. Motz inspect motor control center in Western-Southern's North annex. The starters these men are examining protect and control all motors and auxiliaries in this area. Foreground: one of four 100-ton refrigeration compressors which have automatically maintained a comfort level of 76° temperature, 45% relative humidity since installation during 1955 modernization. These compressors have compiled a flawless performance record without a moment's down time.

J-94157-3

Westinghouse bus duct, that assures full power at loads, is used in all home office buildings. E. C. Nagel, Westinghouse; E. C. Baur; and W. B. Motz, O. W. Motz and Associates, stand before control center served by 1600-amp low-impedance bus duct.



For 25 years Elmer C. Baur, President of Baur Electric, has applied his expert knowledge of electrical products to the efficient electrification of Western-Southern Life's home office buildings.

Western-Southern Life accelerates accounting, billing and actuarial functions with electronic data processing equipment. Heavy power requirements, typified by punch card section, are reliably met by Westinghouse electrical distribution equipment.

By 1962, the annual electrical consumption in Western-Southern Life's home offices will toe the 8,000,000-kwhr mark—virtually a ninefold increase over 1953's 964,800-kwhr consumption.

During expansion and modernization of the company's headquarters, Westinghouse has been—and is—the major source of electrical apparatus. Westinghouse coordinated switchboards, control centers, bus duct, panelboards and other products handle the huge electrical load efficiently and dependably.

For more information about this single source, single responsibility helping Western-Southern Life Power-Up for growth and service, contact your nearest Westinghouse representative. Or, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. *You can be sure . . . if it's Westinghouse.*

Westinghouse

Messrs. Mode, Niemer, Baur and Benz discuss a Size 3 combination Life-Linestarter in this Westinghouse control center. Grouping of starters and feeder circuit breakers in one continuous line-up affords centralized control of circuits, simplifies maintenance, provides a pleasing appearance.

OWNER: The Western and Southern Life Insurance Company, Cincinnati, Ohio
ARCHITECT: Harry Hake and Harry Hake, Jr., Cincinnati, Ohio
CONSULTING ENGINEER: O. W. Motz and Associates, Cincinnati, Ohio
GENERAL CONTRACTOR: Turner Construction Company, Cincinnati, Ohio
ELECTRICAL CONTRACTOR: Baur Electric Company, Cincinnati, Ohio
ELECTRICAL DISTRIBUTOR: Westinghouse Electric Supply Company, Cincinnati, Ohio

J-94157-4

New Champion Paper Office Supported by Armco Piling

Rig drives Armco Pipe Piles with mandrel.

for strength, economy, durability

Photo of model of new office building of The Champion Paper and Fibre Company. Structure is nearing completion.

General Contractor: Frank Messer & Sons, Inc., Cincinnati
Piling Contractor: C. L. Guild Construction Co., Inc., East Providence, R. I.
Architects: Harry Hake & Harry Hake, Jr., Cincinnati; Winkler, Ranck and Beeghly, Hamilton, Ohio

At Hamilton, Ohio, The Champion Paper and Fibre Company is completing a new General Office building. Armco Pipe Piles provide a foundation for this contemporary structure.

These piles are 12-inch, O.D., .133-inch wall thickness. A driving mandrel was used with a Vulcan #1 hammer to drive the 35-ton piles from 14 to 31 feet.

Armco Pipe Piles can be driven with any standard pile-driving equipment. Alignment can be quickly verified by lighting the pile interior before pouring concrete. These piles are supplied in 10- to 22-inch diameters, with a wide range of wall thicknesses. Manufactured to A.S.T.M. Specifications. Write for catalog containing valuable engineering data. Armco Drainage & Metal Products, Inc., 5411C Curtis Street, Middletown, Ohio.

Inspector, with mirror in bright sun, checks interior of Armco Piles for alignment.

ARMCO Drainage & Metal Products

"Quote . . . End Quote"

A Path to Unity

"[Lack of agreement among the engineering societies] is due at least in part to differences in view as to the aims which the profession should hope to achieve. Might not additional progress be made if the leaders of the profession who are working on the problem of increased unity would undertake jointly to crystallize a clear statement of the purposes for which the profession should aim in deciding upon its future organization?

"Particular attention should be given to expressing what goals related to its public responsibilities the profession should seek to achieve. In their deliberations, the leaders would fully take into account the explosive character of our era, both technically and socially . . . study the question in its full breadth and depth [and] consider the problem in its long range aspects, as well as in the light of conditions today.

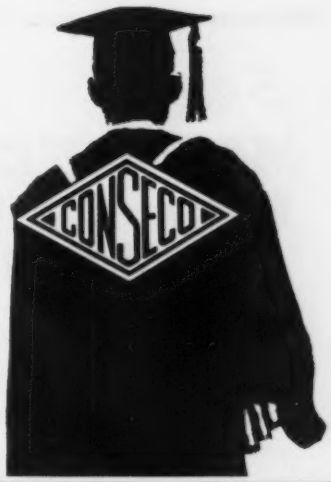
"If our leadership should find it possible to reach agreement to such a basic statement of aims, I believe it would help greatly in reaching agreement on the forms of organization which are best designed to accomplish these aims . . . I believe that the clear expression of high purposes and the recommendations by our leadership of an organization to achieve those purposes, will inspire the general and enthusiastic support of engineers in all branches of the engineering profession.

"So organized and so inspired, the engineering profession can build a place for itself, even greater than it occupies today, in the life of our country and in the esteem of its people." — Dr. Harold S. Osborne to the Winter Meeting of the *American Institute of Electrical Engineers.*

The Engineer and the Law

"The responsibility of the engineer called in to supervise construction of a job is really frightening, and, to my mind, unnecessarily severe in this twentieth century — or rather, in this latter half of the twentieth century. I have no doubt that any one of you, if called upon, could recite the words of this Article 1688 word for word. It provides as follows:

" 'If a building perish in whole or in part within five years, from a defect in construction, or even from the unfavorable nature of the ground, the architect superintending the work, and the builder are



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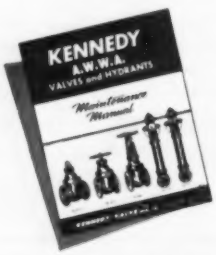
Kennedy non-rising-stem A.W.W.A. gate valves have two "O"-Rings, the top for dirt seal and the bottom for pressure seal. Special feature of Kennedy "O" Ring construction is that the "O" Ring packing lies *above* the collar and therefore permits repacking under pressure. Find out all these Kennedy features and more by writing for Bulletin 611.



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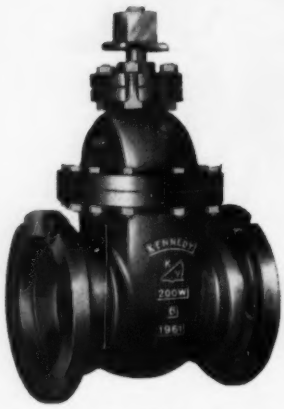

Fig. 571X

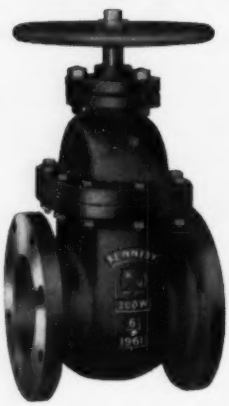

Fig. 561X

Fig. 566

KENNEDY VALVE MFG. CO.
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VALVES • PIPE FITTINGS • FIRE HYDRANTS
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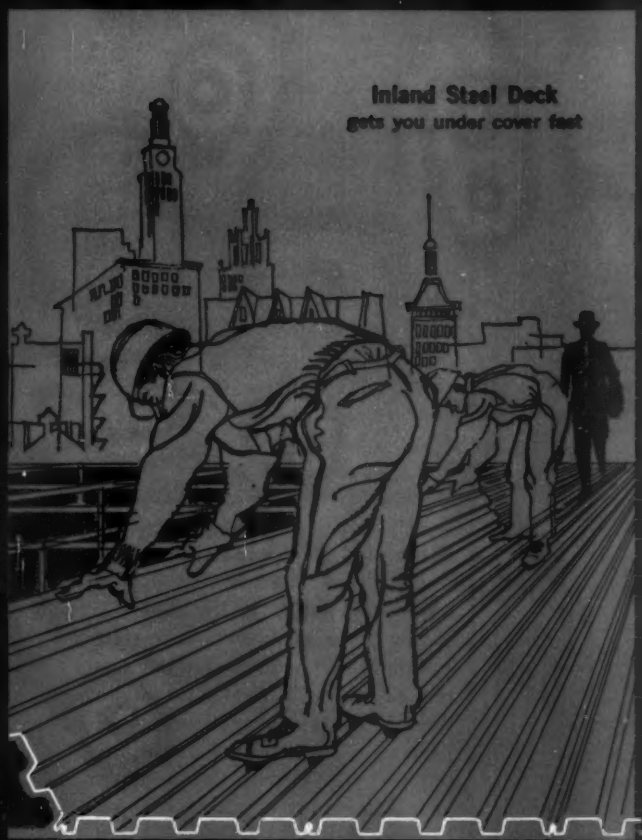
jointly and severally liable for the loss.'

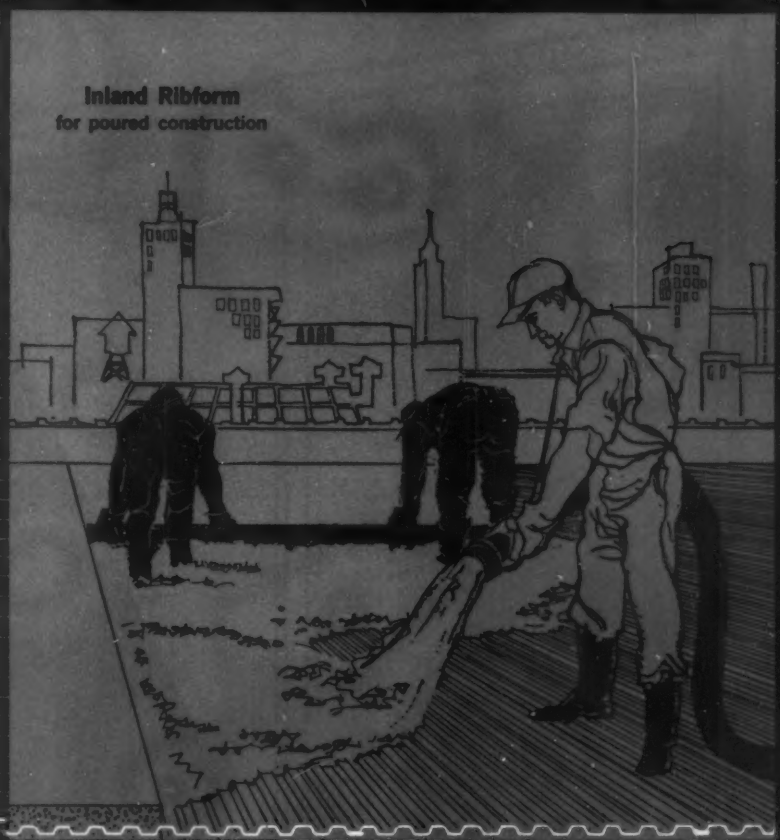
"The Article places the engineer and architect really in the position of an insurer. The engineer is not a mere expert – he must guarantee the result.

"That a certain degree of care and skill should be required of an engineer makes obvious sense. He holds himself out to the public as being an expert in questions of design and construction. He enjoys a monopoly. No one can practice his art without being a qualified member of the Corporation. On the other hand, doctors, lawyers, and chartered accountants are in much the same position, but consider for a moment the degree of skill and care that is required of these professionals.

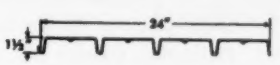
"A doctor is responsible for injury to a patient if it can be shown that the injury resulted from a lack of the standard of proficiency he should possess. This standard of proficiency has, by the cases, been defined as 'the knowledge of an ordinary, competent medical practitioner.' If the doctor holds himself out to be a specialist, as possessing some special skill and knowledge, then he must have and exercise the degree of skill of an average specialist in his field. Within these limitations, a doctor or a specialist is not liable for an honest error of judgment, if he does what he considers best in the patient's interests following a careful examination. Obviously, if the medical profession were held to the kind of warranty imposed on the engineer under Article 1688, then any doctor performing an unsuccessful operation would be ruined. If, however, the doctor has failed to count his sponges or has left some forceps inside the body, then the patient, or his legal heirs, on proof of the presence of the sponge or the forceps in the body, may recover in damages.

"Why then the severity of the rule against the engineer and the architect in construction cases? An



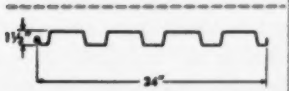


Steel deck or centering...you name it, INLAND has it!



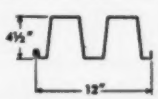
A-DECK — For purlin spacings not exceeding 8'4". Narrow ribs provide deck surface that supports the thinnest or softest types of insulation.

H-DECK — New! For simple spans to 20'0" — 3" and 4½" depths. Especially practical to cover walkways in shopping centers, schools, other installations.

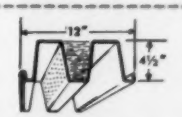


B-DECK — For spans to 10'0". Wide rib distributes metal for greater structural efficiency. Well suited for use as side wall panels.

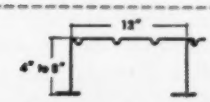
B-ACOUSTIDECK — Two-in-one panel combines steel roof deck with acoustical ceiling having Noise-Reduction Coefficient of .70. Used for spans to 10'0".



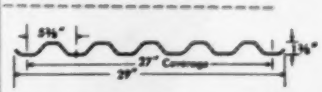
C-DECK—Carries normal roof loads over spans up to 24'0". Used extensively in canopies.



C-ACOUSTIDECK — Offers same Noise-Reduction Coefficient as B-Acoustideck. Can be used for spans to 24'0".



T-STEEL — New! Galvanized only. For clear spans to 32'0". Adaptable to acoustical and flush, luminous ceiling treatments. Provides superior diaphragm to resist seismic and wind loads.



RIBFORM — High-tensile, galvanized steel form for concrete slabs over spans up to 8'0". Three types: Standard, Heavy-Duty, Super-Duty (shown).

Expansion projects and new buildings get under cover fast and economically, when you specify an Inland roof system.

Inland steel deck is easy to handle and weld in place — in any weather that a man can work. Effects of construction abuse are held to a minimum, since types A, B, C, and H decks are Bonderized, then covered with a baked-enamel primer that resists on-the-job damage. One field coat of paint over this is usually enough.

In concrete-over-steel construction, Inland Ribform supports wet concrete with minimum deflection. Rigid sheets are quickly and inexpensively attached to supports — in place, they provide a safe work platform for crews.

Write for catalog 248 – see Sweet's sections 2i/InL. For help on unusual problems, you can draw on the diversified experience of Inland sales engineers. Write or call your nearest Inland office.

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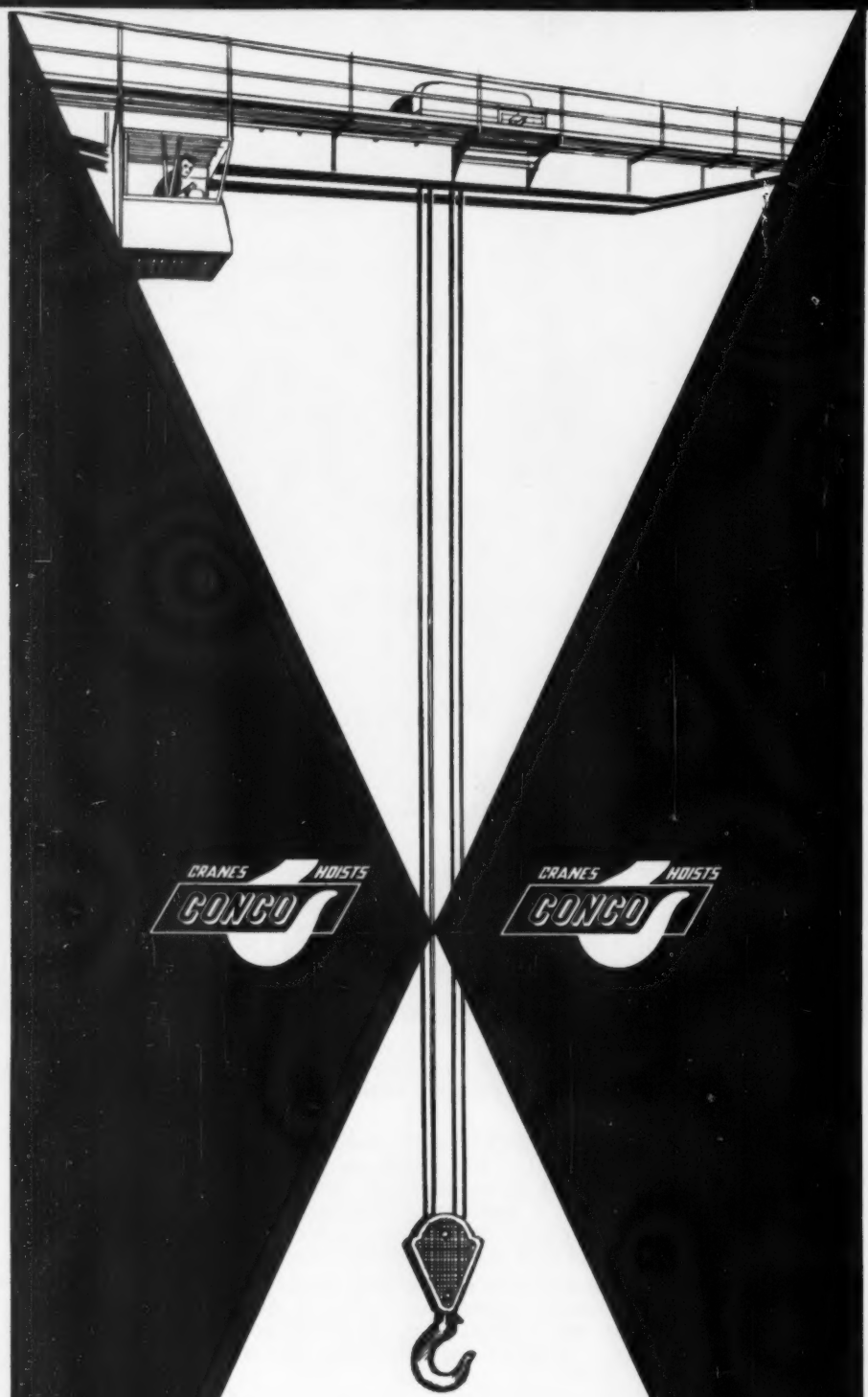

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answer to that is, of course, that engineering is an exact science while medicine and law are not. The proposition that engineering is an exact science is, to my mind, somewhat weakened by the number of failures in rockets leaving their launching pads down in Florida, but then again, I understand that that division known as electronics has not as yet been able to satisfy Murphy's law of engineering to the effect that everything that can go wrong will go wrong.

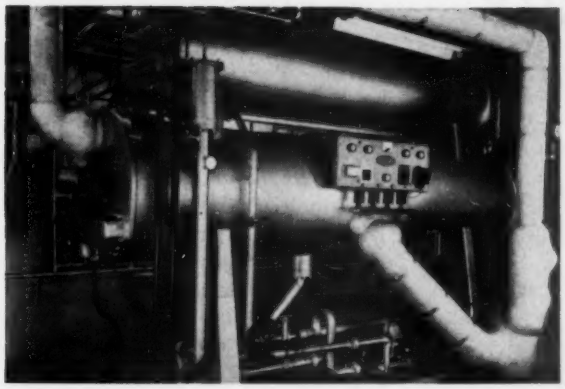
"The textbook tells us that the reason for this warranty imposed upon the engineer is that it is a matter of public order, that the public is to be protected against buildings falling down. But our system of justice is clearly of public order. The prevention of illness and its cure is obviously of public order, so that to set up the principle of public order as an excuse for this extraordinary warranty being placed on the engineer of itself alone just won't do.

"I think, then, that we must come back to the proposition that the rule exists because engineering is an exact science and that being so, the public should be protected against any lack of knowledge on the part of the engineer — his failure to know what he should have known. Buildings should not fall down, or perish by reason of a defect in construction — it is certainly not unreasonable to ask for that!

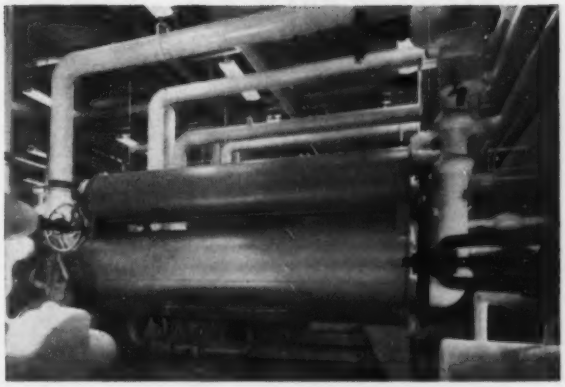
"In other words, it must be admitted that buildings can be so constructed as not to fall down — and if they do, then something is very wrong, someone has been negligent: the thing speaks for itself." — An extract from a talk presented by Mr. Albert L. Bissonette, Advocate, to the M.I.T. Club of Quebec, as published in the *Bulletin*, January 1961.

Structural Steel's Future

" . . . The structural steel frame of the normal industrial facility represents somewhere in the area of 25 percent of the total cost of all



FOURTEEN YEARS AGO, the first Carrier Absorption Refrigeration Machine was installed in the Sealright Corporation's plant in Fulton, New York. This pioneer machine has been in continuous operation ever since.



TODAY, here's one of more than 1500 Carrier Absorption Refrigeration Machines in operation around the world. Today's modern Carrier automatic models cover a wide range of capacities from 50 through 1000 tons.

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3 Since the first machine, Carrier has effected many advances in design in its models. Today's Carrier Automatic Absorption Refrigeration Machines deliver the last word in efficient, reliable, low-cost cooling from low-pressure steam or hot water.

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Whether you're interested in service entrance equipment or a safety switch, you need look no farther than this newest Heinemann circuit breaker unit.

Far smaller than comparably-rated fused pull-outs, it carries a big 200-ampere load—consistently, without any allowances for ambient temperature. De-rating—or any form of temperature compensation—is simply unnecessary. The breaker is magnetically actuated; there's not a thermal element to be found. You can put this equipment next to heat lines, or inside a snow bank; it will always carry full-rated current, always trip as specified.

And it's easy to install. Wiring space is plentiful. So are knockouts (you can run-in conduit from any angle). Solderless screw-type connectors are another time-saver.

Rated at 120/240V AC, two- or three-wire service, this unit is available with indoor or raintight, tamperproof outdoor enclosures. Either way, it costs less than what you are used to paying for fused equipment with 200-ampere capacity after de-rating.

For full information send for Bulletin 1003

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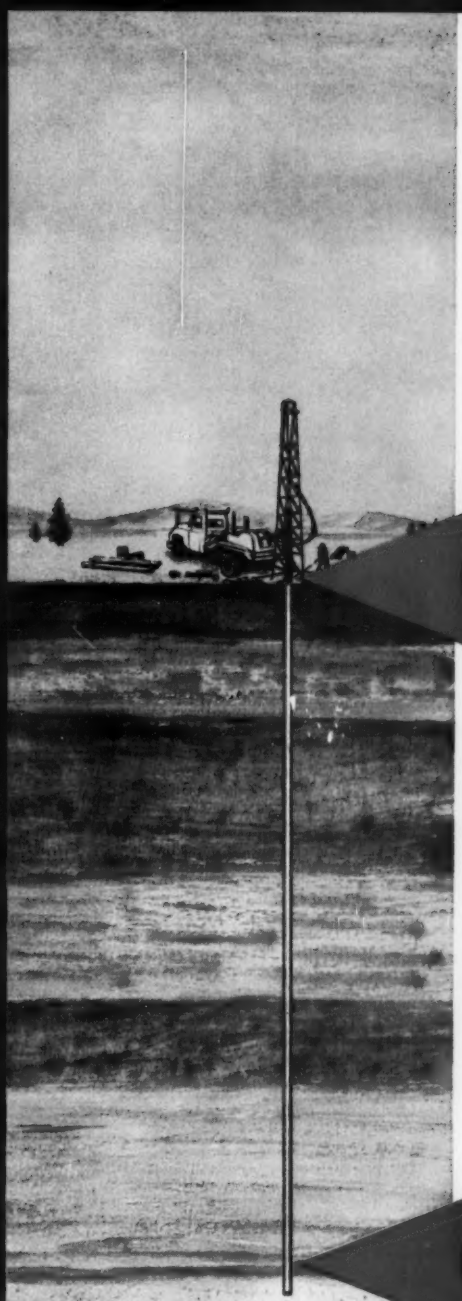
the architectural trades. The ratio of cost between the raw beam or angle, as delivered by the mill to the fabricating shop, to the cost of the fabricated item should be constantly examined to be certain that both rolling mill and fabricator are taking full advantage of labor-saving adaptations. In turn, architects and engineers have a responsibility in design, in standardization and simplification wherever possible.

"The fact that more than 90 percent of our more modern one-story industrial complexes have been constructed with the fundamental structural frame of structural steel does not necessarily mean that this ratio will always prevail. Neither the steel industry nor the engineer can make this assumption. In the competitive market that exists today, it means that any number of projects which normally would be constructed with structural steel will be given a sound screening in competition with other materials, notably reinforced concrete – poured in place, precast, prestressed, or post tensioned. These media, fully analyzed as to adaptability for process change, capital cost, time of construction, fire resistance and other factors, cannot be discarded from consideration by architects and engineers in their service to owners." – George H. Miehls, Albert Kahn Associated Architects and Engineers, in a speech before the *Industrial Building Congress*, December 15, 1960.

And the Influence of Engineering?

"Today there are few if any governmental functions which do not increasingly reflect the influence of science. This fact has been attested to in recent years by the growing demand by government for the services of scientists in fields ranging from agriculture to space exploration; by the creation of such bodies as the National Science Foundation, the Atomic Energy Commission, National Institutes of Health, National Aeronautics and Space Administration; and by the



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Layne Vertical Turbine Pumps are designed, engineered and manufactured by Layne in Memphis, Tennessee and nowhere else. Because pumping needs vary, there is a Layne pump for every pumping requirement—from 30 to 100,000 G.P.M. in sizes from 4 to 42 inches. Layne Pumps include Deep Well and Short Coupled (oil or water lubricated), Propeller, Mixed Flow, Regular and "In-Line" Submersible. For additional information write for bulletins 200-oil lubricated or 201-water lubricated.

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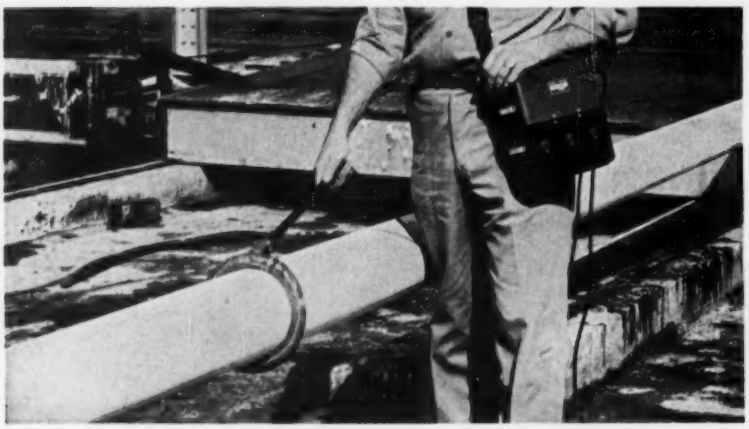
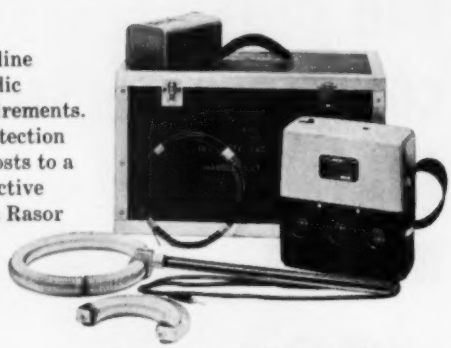


TINKER & RASOR HOLIDAY DETECTORS

insure coating continuity

Every void in your pipeline coating increases cathodic protection current requirements. To obtain maximum protection and hold maintenance costs to a minimum, inspect protective coating with a Tinker & Rasor Holiday Detector and make repairs before backfilling.



Tinker & Rasor E P Holiday Detector.
Portable, "damp-climate" pulse type.

Write for your free Data Kit.

Tinker & Rasor has prepared a complete data kit of descriptive material and recommended procedures for inspecting protective coatings. Material includes technical data on equipment, recommended inspection procedures, general discussion of types of detectors, theory of operation, etc.

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Quality Control for Coating Application

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appointment of a Special Assistant to the President for Science and Technology. Conversely, the efforts of government have had a substantial influence on the nature and direction of the Nation's scientific activity.

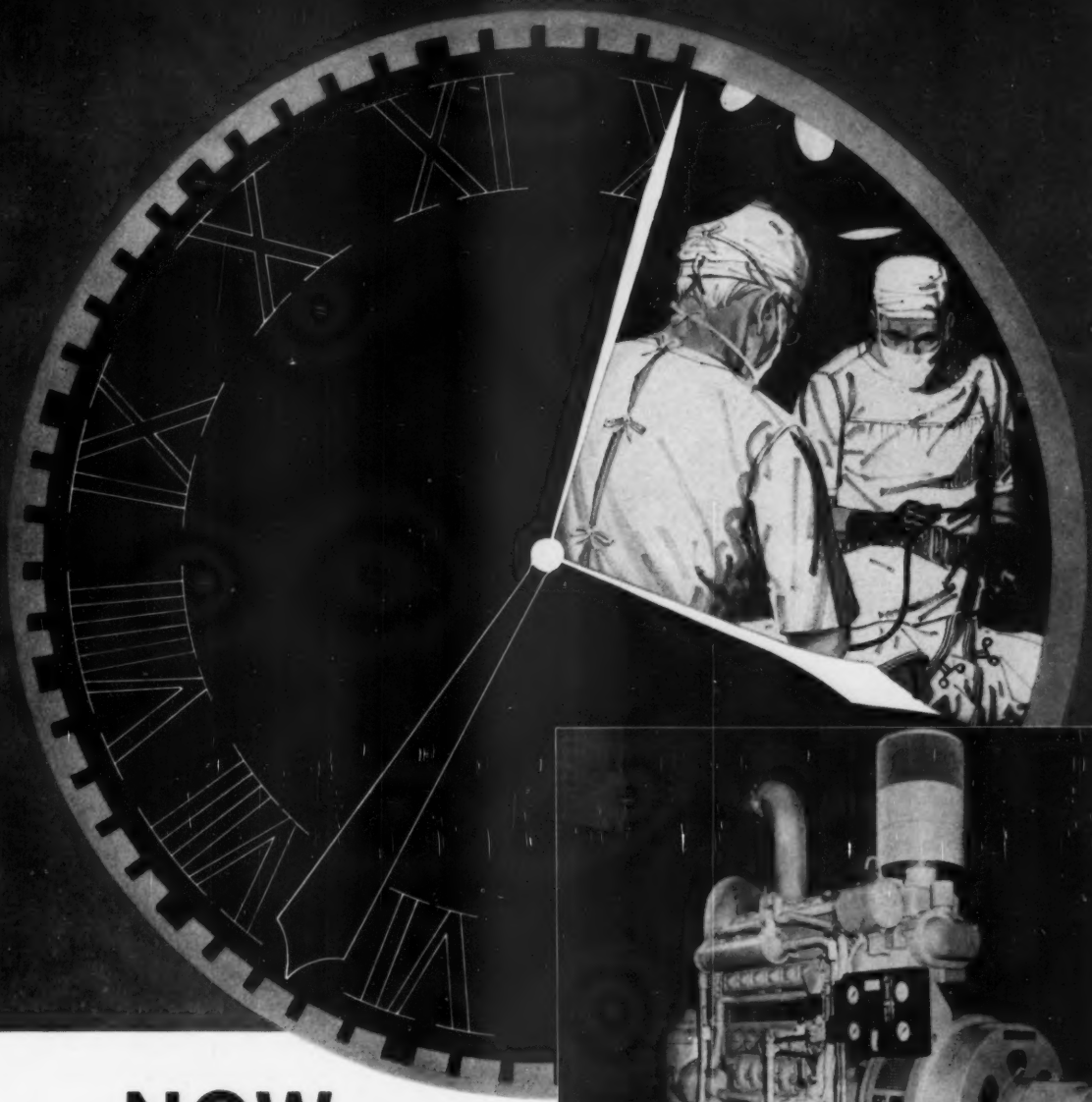
"The establishment of the Office of the Science Adviser, backed by a corps of scientific attaches abroad, is but one device being used by one agency of the government to help meet the problems arising from the interacting relationship between science and government. The over-all problem is one affecting virtually all governmental agencies and their relations with one another. Moreover, it is not uniquely an American problem — many foreign governments, including those of India, Pakistan, the United Kingdom, and France, are also attempting to set up adequate machinery for this purpose.

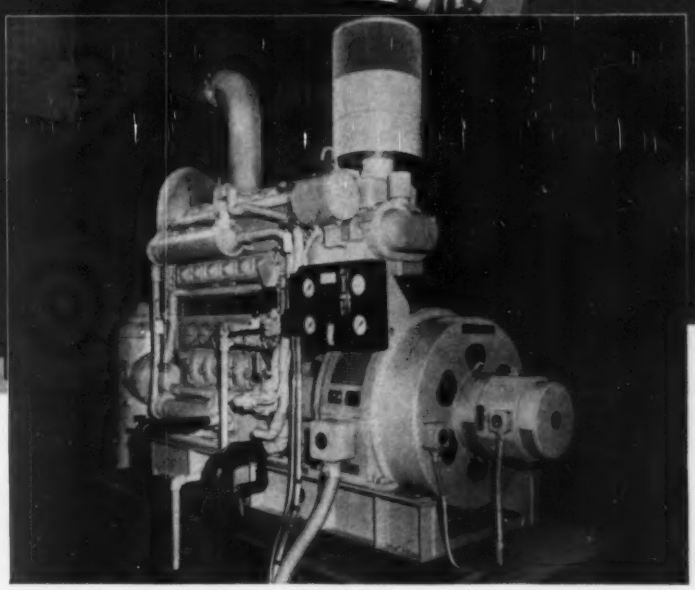
"But the problem is particularly acute in the sphere of foreign relations. Some two dozen foreign nations have recognized this through the appointments of scientific attaches to their embassies in Washington. In fact, many of these attaches are permanent government officials and professional scientific administrators rather than research scientists. These governments long ago recognized the value to their foreign offices of sound scientific advice and information." — *The Science Adviser of the Department of State*, Department of State Publication 7056.

Where Ethics Begin

"Now comes the real question. How can you motivate engineering students to take ethics seriously? Answers to that question must wait for other discussions. I doubt if I am competent to give the answers, but I should like to leave a few suggestions for your consideration.

"First, I should think there can hardly be a more powerful motivating influence than your own impeccable deportment and attitude. Anything like favoritism or other





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Model 38F5¼ is a compact, self-contained Diesel generating package with all the advantages of a larger model, delivering more kilowatts at less cost and in less time than any other similar unit. From cold start to full power in 15 seconds.

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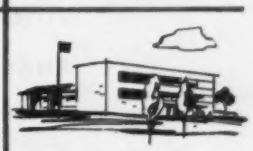

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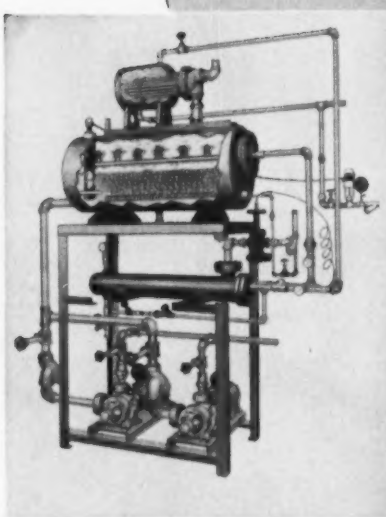

Day-in-day-out under boiler load swings as great as 10-to-1—**not** just under favorable fixed test conditions.

Excellent thermal efficiency (insignificant steam vent loss) under **all** regular operating conditions – with no vent adjustment for any load change.

No need for sodium sulphite or other additives. (If you need 'em, you just aren't getting full mechanical deaeration).

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All are the result of the unique, but 15-year proved, Schaub design for external superheating, explosive flashdown and fully-vented operation.

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Name_____

inequality in relations with students is deadly. Students may be cynical about their faculties, but a respected professor dominates his students.

"Second, you can frequently appeal to the American sense of generosity and fair play, not so much in the abstract but by using dramatic illustrations. Fair play derives from ethics, I suppose, but at the same time it is a motive for ethics. Fair play is one of the strongest American ideals or aspirations. If you can make your student realize that fair play and ethics dovetail together, you will have made an excellent start toward motivation.

"Third, there is the Golden Rule, another well known ideal for Americans. It has possibly somewhat less appeal for boys than fair play because it is not so masculine in tone, but the Golden Rule is a strong motive nevertheless.

"Fourth, you can remind the student that the ethical and upright engineer enjoys peace of mind while the unethical and dishonest engineer is tormented by worry and fear. He always has to be sure that he is consistent in all the lies he has to tell to cover up his illegitimate operations.

"Fifth, there is an appeal to religion. Ethics and religion differ widely, of course, in their bases and origin. Ethics isn't religion at all, it is philosophy. But the fact remains that the student who obeys the Ten Commandments is bound to be ethical in his deportment. The difficulty is that you don't know who of your students is religious. Figures have been published to show that there is an important resurgence of religion in the United States, but it doesn't follow as yet that you can stir the typical engineering class by an appeal to religion.

"To me, religion seems to be the most potent of the motives. I remember reading in January that the late Albert Camus, French author and philosopher, had found it dif-

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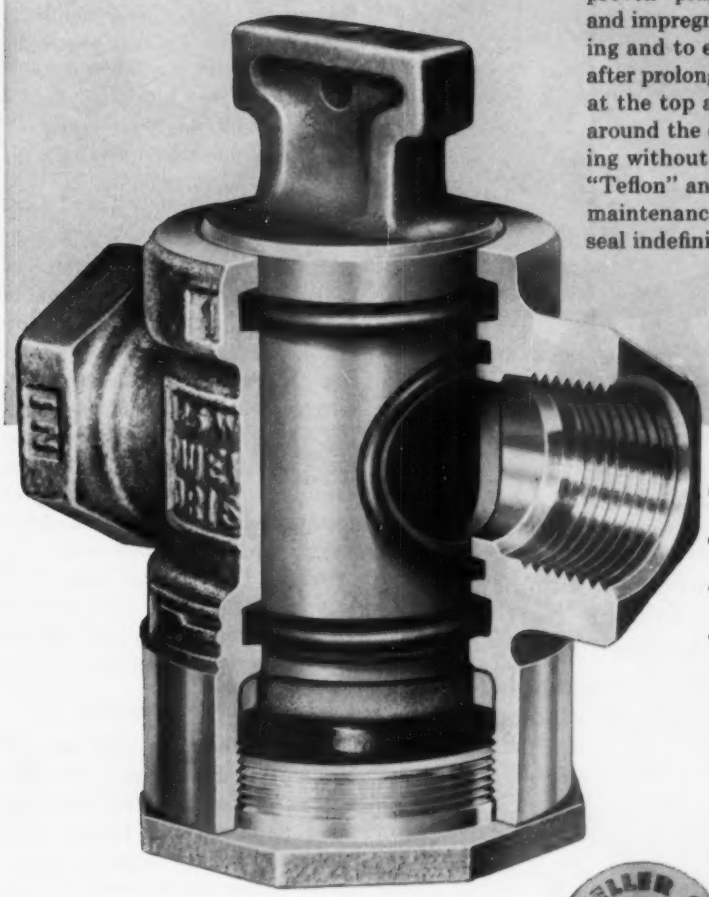

- Easy to operate—anytime!
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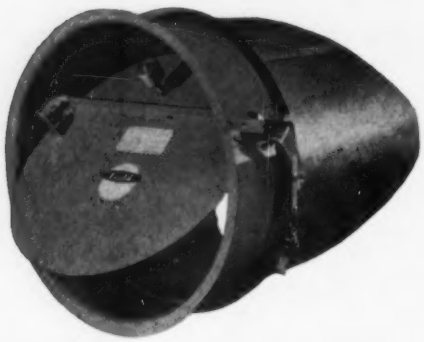

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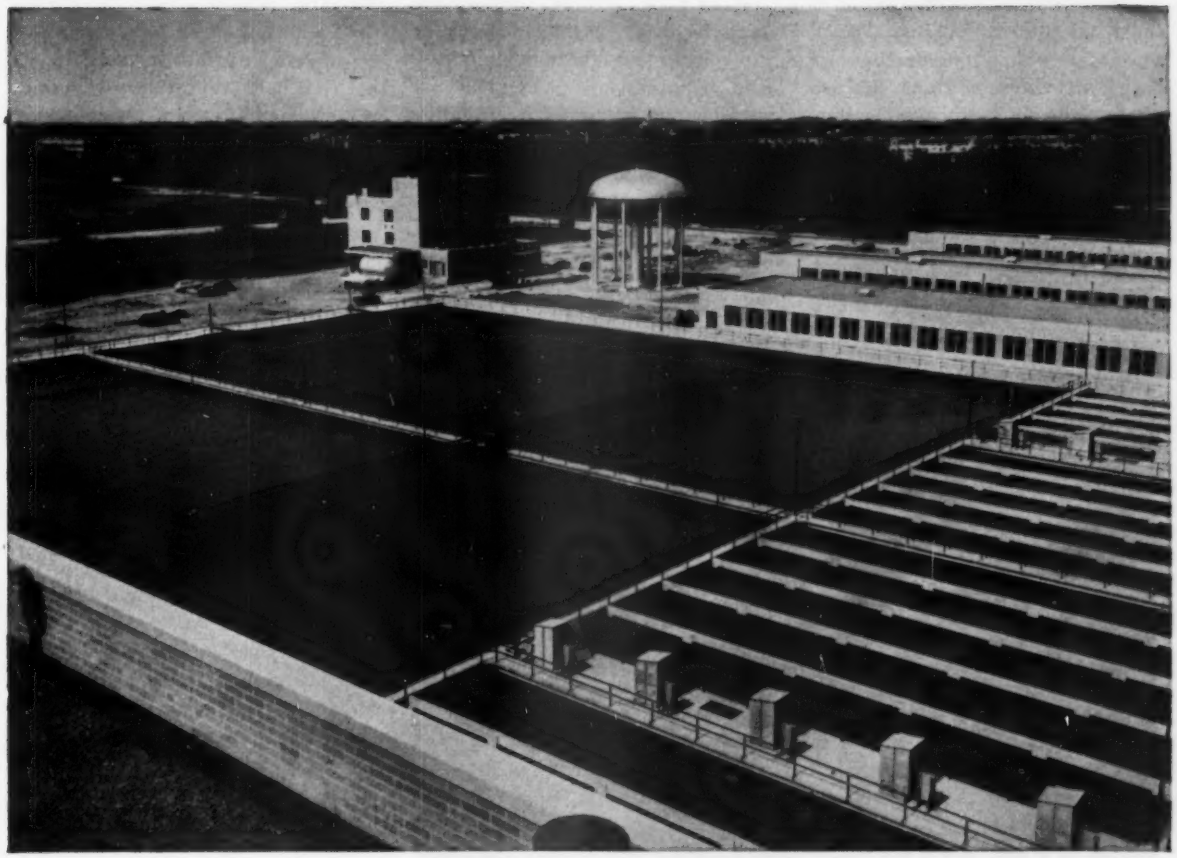
ficult to build up a philosophy of life without God. I am no philosopher, but my answer is, don't build a philosophy of life without God; build it around God. . . .

"Sixth, you can impress your students by relating cases of the best kind of ethical behavior. I am thinking of one such case, not in the engineering profession at all. Quaid-i-Azam Mohammad Ali Jinnah was the George Washington of Pakistan. He was both a practicing lawyer and an influential member of the Assembly or Parliament. He was much concerned about a bill in the Assembly which would strongly influence the national welfare. His opponents in the Assembly prevailed upon one of his clients to retain him for an important case and to offer him a fee of 100,000 rupees. Then they scheduled a conference with Jinnah about the case on the day the bill was to be debated in the Assembly. Jinnah saw through the ruse and contemptuously turned down the case, and the 100,000 rupees.

"The engineering teacher must be sincere about the teaching of ethics. If he goes through the motions of teaching and urging ethics, but remains cynical himself, students will soon detect his deception. You can't fool students very long. Such a teacher will get no results. Indeed, he is probably being quite unethical himself. In any case, he does not belong in a professional school, and the sooner he resigns or departs otherwise, the better." – C. J. Freund, Dean, College of Engineering, University of Detroit, in the January 1961 *Journal of Engineering Education.*

Engineers and/or Scientists

"Every satellite that goes into orbit, we often hear, is a scientific success; while every one that does not is an engineering failure. This, of course, is sheer nonsense. Statements of this sort can exist as anything except weak jokes only because people – many people, at any rate – seem not to know or to



Philadelphia's push-button treatment plant uses

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With the completion of the new Torresdale plant, Philadelphia not only fulfills its dream of a completely modern water treatment system, but also possesses a show place of advanced equipment and design ideas.

An extensive system of automatic and semi-automatic controls makes this literally a "push-button" plant. Contributing to its high efficiency are important items of Dorr-Oliver equipment. Four Dorrco Flocculators are installed, each with five rows of paddles 14′ dia. x 174′6″ long spaced on 19′7″ centers. There are also four Dorr Cross-Flow Squarex Clarifiers, each 174′6″ square x 19′6″ s.w.d. Maximum design capacity of the plant, one-half of which is shown above, is 423 MGD. Dorr-Oliver Incorporated, Stamford, Connecticut.

Consulting Engineers: Morris Knowles Inc., Pittsburgh, Pa. Contractors: McCloskey and Company, Philadelphia, Pa.

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understand the difference between science and engineering.

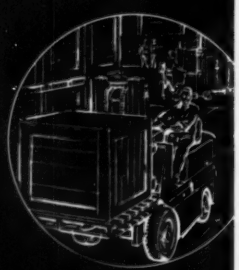
"As difficult as it sometimes is to draw the distinction in actual practice, science and engineering are clearly not the same thing. Science aims at the discovery, verification, and organization of fact and information. Its goal is an understanding of the world we live in and of ourselves as part of that world. It seeks truth and knowledge. The scientist puts nature under his microscope to discover how it behaves and why it behaves that way. Having done this, he seeks to order the facts he discovers into general, or 'universal,' laws through induction and hypothesis — laws that can stand as an accurate, quantitative description of the organization and operation of nature.

" . . . an engineer is not a scientist. For an experience of similar significance and relevance, the advanced engineering student must be given the opportunity to practice engineering, not science. For this, he must be given the opportunity to learn and to practice design, to create something new, rather than to explore why and how something works that already exists. A person does not learn to paint by studying art criticism. Rather, he learns to paint by painting under the guidance of a competent artist. Nor does a person become an engineer by studying the procedures of science. He learns, if he is going to learn, through the successful completion of a design problem. . . .

" . . . To guide their students, professors of engineering should maintain their proficiency as engineers. This means that they must continue to practice engineering — that is, they must continue to be involved in the design and creation of new machines, new systems, and the like. Characteristically, professors at our medical schools are also practicing physicians and surgeons. They keep abreast of their field of expertise through actual practice. Traditionally, professors of physics and chemistry are also practicing scientists, who do much of their teaching by permitting their students to work alongside them as apprentices. Professors of engineering, to be most effective in their teaching, should also be practicing engineers, or, at least, consulting engineers in a position to see and experience at first hand the solution of difficult design problems by competent practicing engineers.

"If the knowledge we discover is to mean anything to us, is to be of any value to us, we must continue to honor and to teach its use through creative engineering design. Science without engineering will lead to erudition without proggress, to knowledge without advance, to intellectual dilettantism and creative sterility." — Eric A. Walker, President, The Pennsylvania State University, in the *Journal of Engineering Education*, February 1961. ▲▲

SHOULD YOU RECOMMEND EMERGENCY LIGHTING TO YOUR CLIENTS?



Statistics show that power fails for 60 minutes in any four and one-half year period with multiple underground transmission . . . up to 50 minutes in every eleven month period in some rural areas.

Based on these figures, no building should be without emergency lighting.

To make your recommendation job easier, Light Warden offers you the Emergency Lighting Handbook. Edited by a Professional Engineer, the Handbook includes typical installations, design problems, efficiencies and information on available lighting units.

A copy of the Emergency Lighting Handbook will be return-mailed at your request. Please write on your letterhead.

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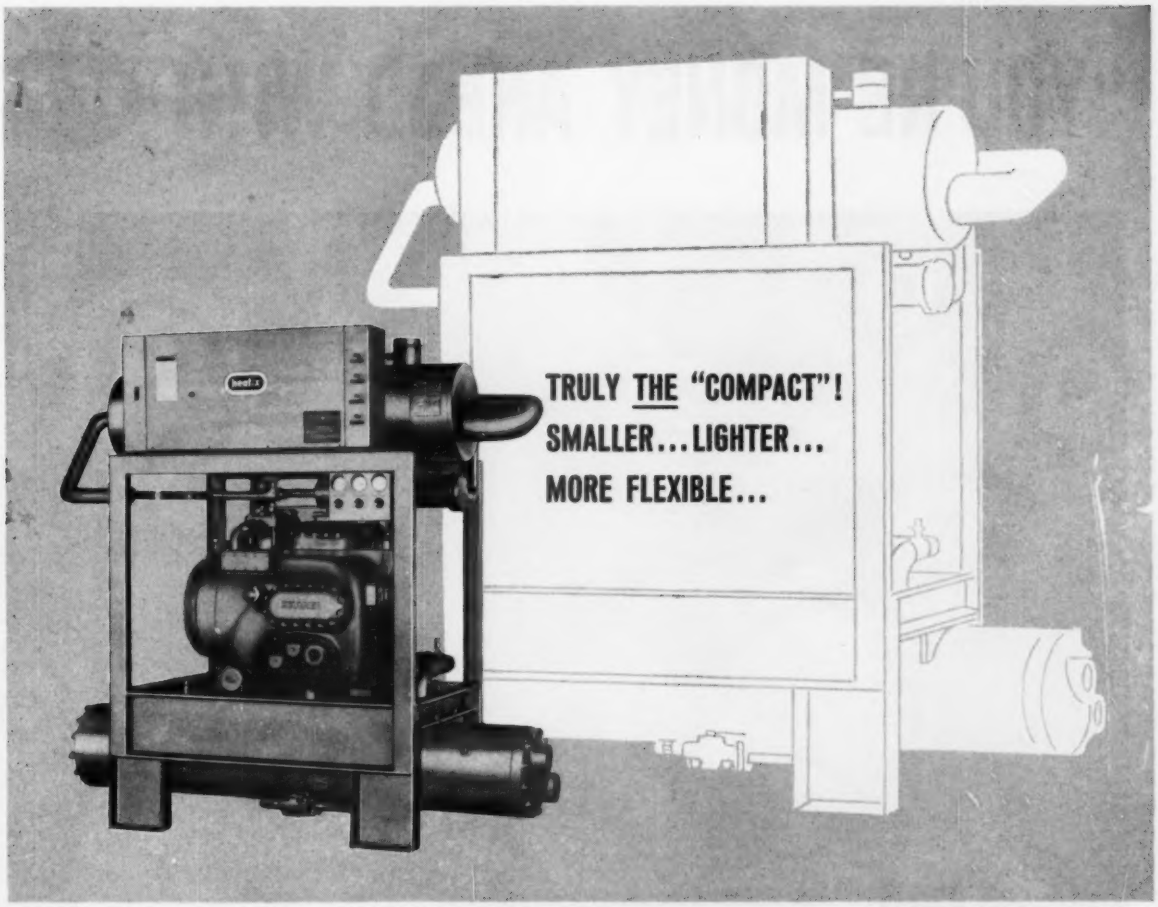

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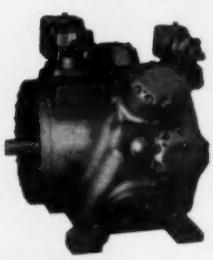

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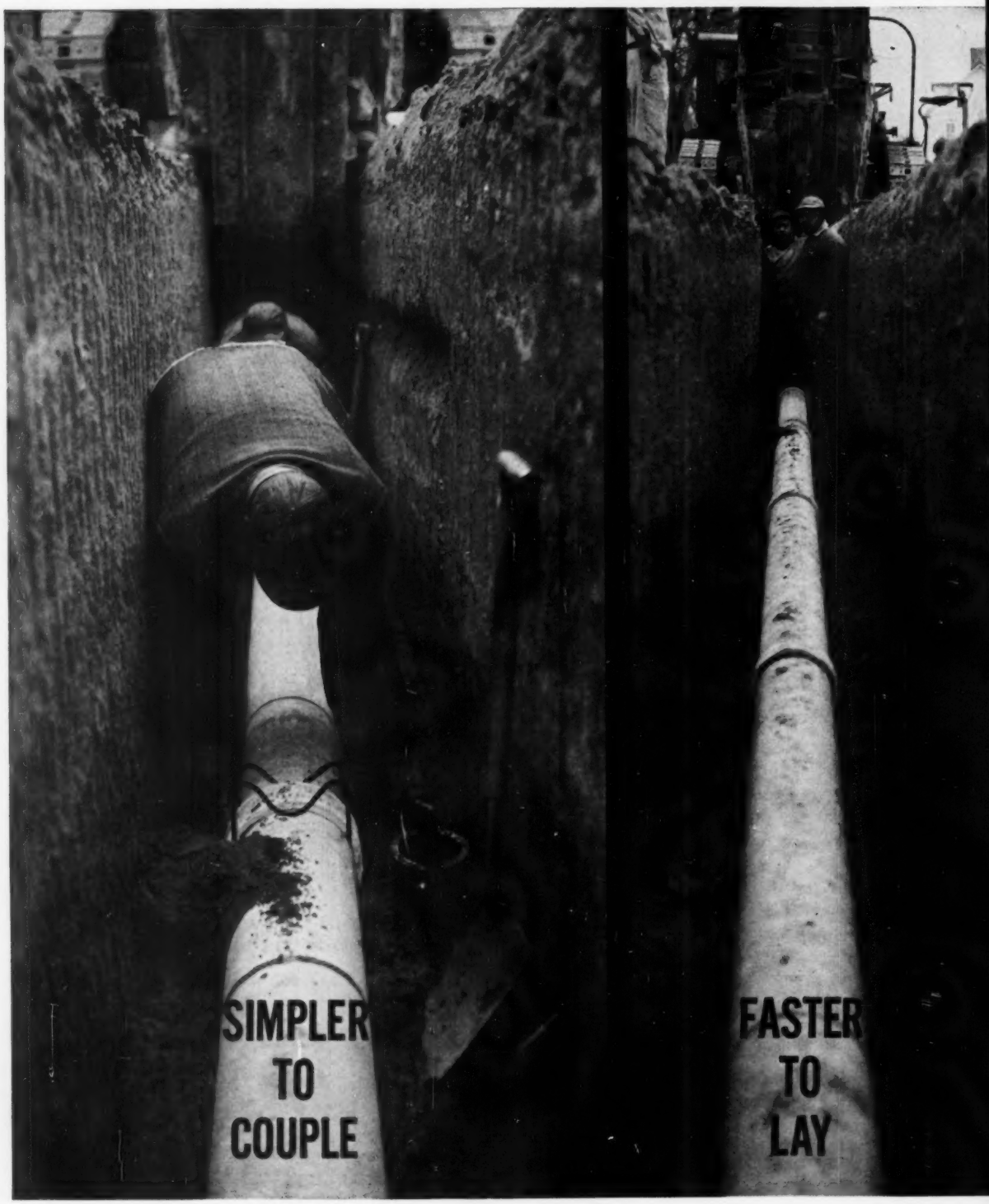

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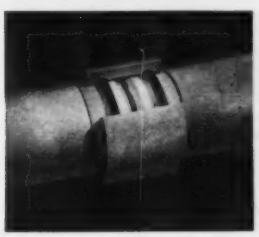
. . . after laying more than 6 miles of "K&M" asbestos-cement sewer pipe

With the completion of the new sewer installation in New Jersey's thriving town of Marlton, Clyde Fear of Gray & Fear, contractors, had lots to say about "K&M" Asbestos-Cement Sewer Pipe. Here's what he told us. "You're money ahead with "K&M" Asbestos-Cement Sewer Pipe. Our men like the simple "K&M" couplings that slide in fast without any heavy machinery, and, believe us, that's one place where we save time and money. These simple coupling joints go miles faster. The pipe is easy to handle; there's less breakage on the job or in the storage yard. No lost time because of bad weather, either, because we can lay and couple this pipe in muddy trenches."

What Marlton, New Jersey, gained with "K&M" Asbestos-Cement Sewer Pipe, you can gain for your community, too. The pipe's smooth bore remains clean. This permits flatter grades . . . means fewer lift stations and lower pumping costs. It all adds up to less tax money for sewer installation and maintenance for your community.

Write today for more information on "K&M" Asbestos-Cement Sewer Pipe. Write to: *Keasbey & Mattison Company, Ambler, Pa., Dept. P-1241.*



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NSPE Report:

▶ Competitive Bidding Clarified

▶ Functional Section Meeting

THE NATIONAL Society of Professional Engineers, in order to clarify contradictions and ambiguities in its rules and policies regarding competitive bidding, has made an official revision which considerably strengthens the group's position.

Rule 49 formerly read, "Competition between engineers for employment on the basis of professional fees or charges is considered unethical practice by all professional engineering groups. Hence, the announced intent of an owner or governmental body to request such competitive bids removes from consideration many engineers who may be the best qualified to be entrusted with the work."

The second sentence was deleted, and instead the rule now adds, "Any engineer who is requested to submit a competitive bid to an owner or a governmental body should remove himself from consideration for the proposed work." Formerly, Rule 49 read as if NSPE merely lamented the fact that good engineers lose work when competitive bidding is requested. The new statement has the engineer remove himself from consideration when an engineer is being selected on a fee basis.

Rule 50 formerly read (in part), ". . . A statement of monetary remuneration expected should be avoided if possible. Should such a statement be deemed necessary, the proposed fee shall be equal to or more than the fees recommended as minimum for the particular type of service required as established by fee schedules or practice in the geographical area where the work is to be done. Where a fee cannot be established in this manner, the ethical fee shall be equal to actual cost plus overhead plus a reasonable profit."

The Ethical Practices Committee noted that the rule contradicted the NSPE position against competitive bidding by permitting a "statement of monetary remuneration" if demanded by the client.

So instead of the portion of Policy 50 quoted above, it was voted to substitute, "A statement of monetary remuneration expected shall be avoided until he has been selected for the proposed work. Should the owner insist upon a statement regarding remuneration prior to selection of the engineer, the engineer may designate the recognized professional society minimum fee schedule for the particular type of service required in the geographical area where the work is to be done."

Also in Policy 10, NSPE formerly was on record as "favoring the practice of negotiating for contracts in all cases where it may be necessary or desirable to consider the services of more than one engineering consultant or organization." This was amended to explain that NSPE now "recommends negotiating contracts . . ."

An addition to Policy 10 is a definition of competitive bidding: "Competitive bidding for professional engineering services is defined as the formal or informal submission, or receipt, of verbal or written estimates of cost or pro-

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All have body and stem guides machined from solid bar stock to provide extra strength and valve life.

All have precision ground stems and long fine-pitched accurately-machined stem threads for micrometer regulation and tight shut-off.

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posals in terms of dollars, man days of work required, percentage of construction cost, or any other measure of compensation whereby the prospective client may compare services on a price basis prior to the time that one engineer, or one engineering organization, has been selected for negotiations. The disclosure of recommended minimum or median fee schedules prepared by various engineering societies is not considered to constitute competitive bidding."

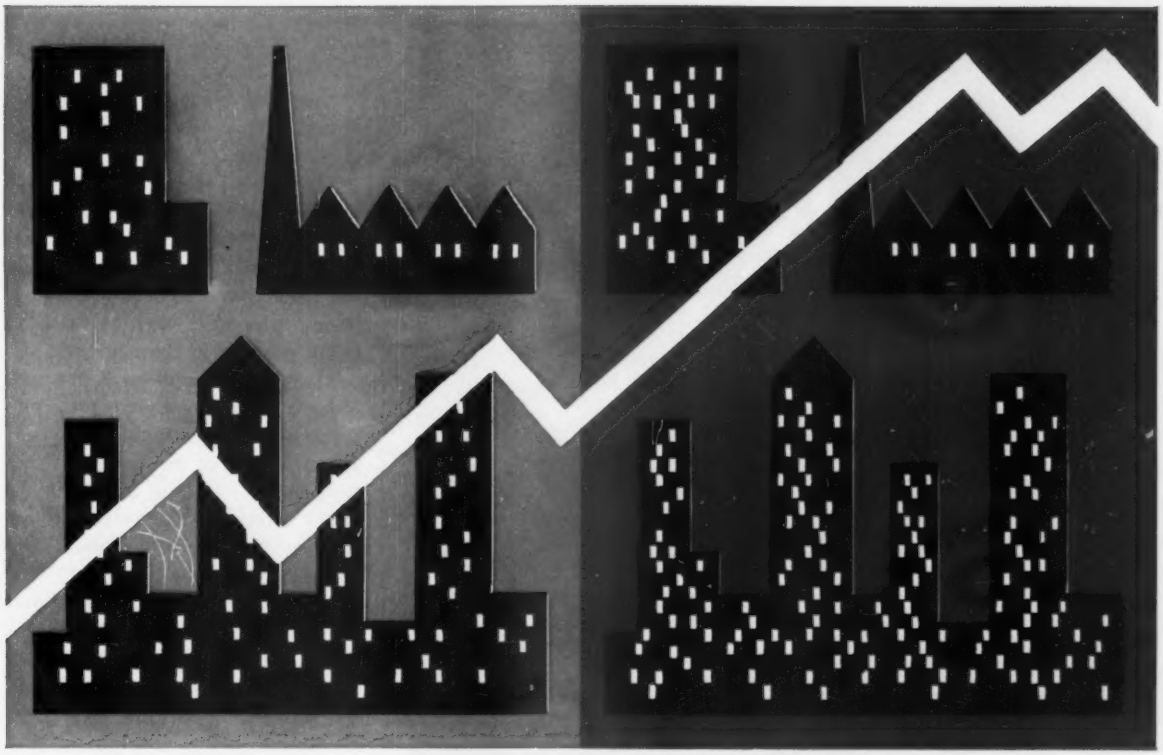
In Policy 11, which gets down to specifics, the first rule stands unchanged: "Any governmental unit, individual, or corporation desiring to procure the services of an engineering consultant or organization which is unacquainted with the practitioners in the branch of engineering covering the contemplated work, should secure from the best available sources the names of several practitioners."

And in the old Policy 2, "[It is the policy of the Society] That the governmental unit, individual, or corporation discuss the proposed project with the several engineers and explore their background, experience, and success in handling work of a nature comparable to that proposed, and also as to the nature of their charges and the manner and basis on which they would expect to be compensated."

The Board of Ethical Review noted that this rule permitted a discussion of charges before the final selection of the engineer, "whereas it should deal only with the manner and method of payment rather than with the amount."

So Policy 2 now reads: "The client should discuss the proposed project with a practitioner or practitioners, considering background, experience, staff qualifications, present work load, and other factors deemed relevant for the successful handling of the project assignment."

Another deletion from the former Policy was, ". . . if so desired, the proposed charges be compared



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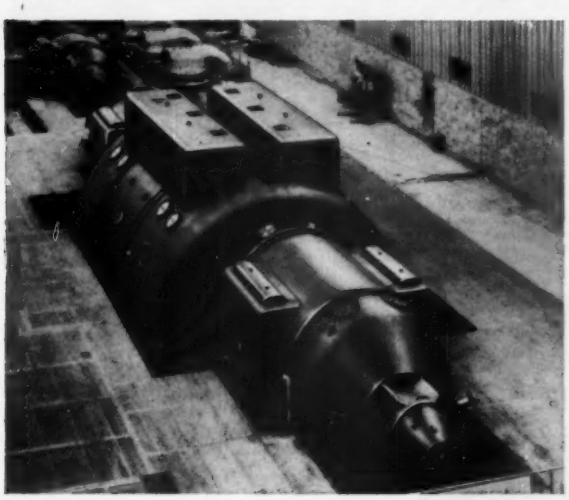
Turbines rated 160 MW may be cold-started and synchronized within 35 minutes, loading rate limited only by steam availability; smaller units require as little as five minutes for similar start-ups. Peak loads are easily handled by quick and simple starting ... operates at any load with efficiencies superior in heat rate performance to existing conventional designs. Hydrogen cooled generators give increased capacity with reduced size.



Two 160 MW machines installed in an underground power station at Stenungsund, Sweden, have achieved an overall efficiency including boilers and auxiliaries of 39%. This station, operated by the Swedish State Power Board, is the world's largest, newest underground steam power plant; a certified turbine heat rate of 7,785 btu/kwhr. has been achieved by these STAL machines.

For information about STAL's unique features and positive operating advantages, write: *East Coast:* ASEA Electric Inc., 500 Fifth Avenue, New York 36, N. Y. *West Coast:* 55 New Montgomery Street, San Francisco 5, Calif.

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● Because Fairbanks Valves are Quality—DEPENDABLE—products.

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● Because Fairbanks offers a full line of Bronze and Iron Body Valves for heating, piping and air conditioning systems.

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with Recommended Minimum Fee Schedules prepared by the various engineering societies, giving due consideration to the complexity of the project."

The Board noted that it was hardly possible to compare proposed charges with recommended minimum fee schedules unless the engineer has furnished or discussed proposed charges prior to being selected as the engineer.

Therefore, Numbers 3 through 6 have been combined into two rulings: "3. After taking into consideration all of the pertinent factors, except fee, the client should select a firm for the work, subject to negotiation of a satisfactory contract.

"4. In the event the client and selected firm are unable to negotiate a satisfactory contract, including fee, the selected firm should be notified, in writing, that it is no longer being considered, and the client should proceed with similar discussions with another firm in the same manner, and thereafter if the second negotiations are unsuccessful until satisfactory arrangements have been concluded with a qualified firm."

Report on Functionals

The National Society of Professional Engineers functional section for engineers in private practice has voted to:

¶ Compile a list of Federal agency policies regarding the use of consulting engineers.

¶ Investigate a possible summit meeting with Consulting Engineers Council officers.

¶ Go on record against the proposed American Road Builders' Association engineering division committee report on prequalification for consulting engineers.

At the NSPE winter meeting, the functional section reported that, "As a first step in considering ways in which consulting engineers in private practice can better serve and work with governmental organizations at all levels, the Com-

Why Kennard/Nelson's 2-line idea is important to you!

NOW *any* air conditioning system you design—regardless of whether quality or cost comes first—can include reliable performance and complete air engineering service from Kennard/Nelson*. Kennard/Nelson is the first manufacturer to introduce *two lines* of packaged central station air conditioning equipment . . . and the first to offer you a choice for clients who want higher quality without using expensive custom construction.

One line of air conditioning equipment is designed to "meet or exceed" industry standards. But the other line—the Kennard/Nelson "Better Air" line—offers you life-of-the-building construction and unmatched operating economy. Here are a few reasons why a *Better Air* unit will "pay its own way" in your system:

1 "Better Air" line introduces life-of-the-building design for air conditioning systems!

• **PENTA-POST FRAMES.** Only Kennard/Nelson *Better Air* units offer rugged Penta-Post frame construction. These heavy-gauge steel frames feature solid 5-angle, all-welded construction. *Better Air* frame design adds years to unit life and holds maintenance costs to a minimum.

BETTER AIR CONSTRUCTION (TYPE A)

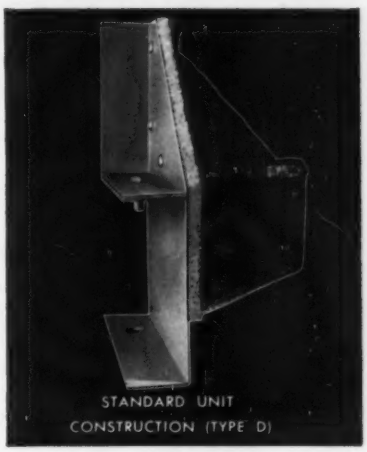
• **DOUBLE DRAIN PANS.** Two separate drain pans, divided by a one-inch pad of insulation, cut replacement costs. Pans slope for more efficient drainage, and inner pans are available in long-lasting galvanized, copper, or other metals.

• **FLUSH-MOUNTED DESIGN.** Every component on *Better Air* units is made easily accessible through flush-mounted service panels with quick-opening doors. Handy exterior access handles make service faster and more convenient.

• **CLASS I FANS.** Every Kennard/Nelson air conditioning unit is equipped with high-efficiency Class I fans. Forwardly curved fan design is standard equipment although backwardly inclined fans are available.
Factory-engineered "built-in" air cleaning allows engineers to specify the exact type and degree of air cleaning desired on *all* models in the *Better Air* line.

2 "Standard" line offers many better air features, wide range of sizes!

On the other hand, the Kennard/Nelson "Standard" line, offered with many "Better Air" features, is designed for those installations where *cost* is the primary concern. Class I fans are also included on all Kennard/Nelson "Standard" units. Standard units are equipped with the same efficient hydraulically-expanded, non-ferrous plate fin coils as are used in "Better Air" units.



STANDARD UNIT CONSTRUCTION (TYPE D)

Both Kennard/Nelson lines are available in a wide range of sizes and arrangements. There are 14 basic sizes and 24 different arrangements (500 cfm to 36,000 cfm) in the "Better Air" line alone.

Discuss the merits of *both* lines with your Kennard/Nelson representative. Ask him for the new bulletin covering each line or write for Bulletins No. AC-100 (Better Air Line) and No. D-100 (Standard Line): American Air Filter Company, Inc., 300 Central Avenue, Louisville 8, Kentucky.

**Herman Nelson and Kennard, for years familiar names in the heating, ventilating, and air conditioning industry, have been combined as a single division of the American Air Filter Company, Inc.*

AAF American Air Filter
BETTER AIR IS OUR BUSINESS

mittee felt it advisable to compile a complete listing of the current policies of Federal agencies regarding the use of consulting engineers on projects under their administration. In view of the fact that some of this information was already available at NSPE headquarters in Washington, Chairman [L. M.] Van Doren, representing the Functional Section, volunteered to undertake the project. Subsequently, a memorandum was sent to all Federal agencies controlling projects involving engineering services. Response to the memorandum was excellent, and it is expected that the close cooperation of these various groups representing consultants should do much to provide mutual support and reduce duplication of effort."

Van Doren reported on an inquiry he had received from CEC asking how the two groups could avoid duplication of effort and establish general cooperation. A joint meeting of the two executive committees has been suggested to resolve this problem.

The executive committee also has sent a report to the ARBA engineering division unanimously objecting to the proposed prequalification of consulting engineers in the highway field. "A basic factor in opposing the plan was that qualification for engineering work is presently accomplished through state engineering registration," the executive committee added.

"Consideration was given to the ethical aspects of advertisements by industrial firms featuring pictures and text on consulting engineering firms which had used the particular product of the advertising firm in an engineering project. The NSPE Board of Ethical Review has indicated that such advertising, insofar as it features the engineers or engineering firms in a special way as related to the product, is objectionable. The ASCE Ethics Committee has indicated an interest in the same question, and it was considered desirable to coordinate the views of the two groups. The Professional Practices Committee will review the entire question of advertising by or featuring consulting engineers or consulting engineering firms."

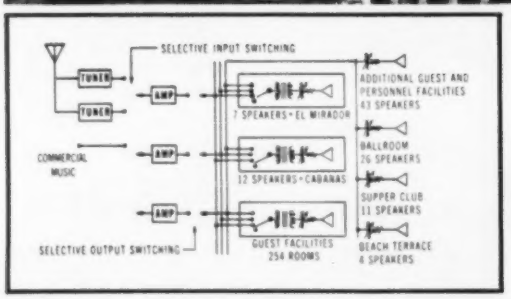
In a discussion of internal matters, it was agreed that the six regional meetings of Functional Sections have been successful in encouraging formation of new state and local functional groups, and a new series of regional gatherings tentatively has been scheduled for the spring.

And in order to keep control and support of the national Functional Section activities at a local level, it was voted to raise additional funds from contributions solicited in existing state sections rather than by national section solicitations. The suggested formula for contributions was left at $5 per registered engineer in each member firm. The anticipated income this year is $16,000. ▲▲

SOUND SOLUTION TO A SOUND PROBLEM:

ALTEC SOUND SYSTEM

Specified for La Concha Hotel San Juan, Puerto Rico



CASE HISTORY FILE 59-36: The luxurious resort and entertainment facilities at the new La Concha Hotel include 254 rooms, 12 pool-side cabanas, terrace gardens, supper club, ballroom, bar, and cafeteria.

SOUND PROBLEM: Because of location, the system selected had to be easy to install, easy to operate. And, most important, the system had to have uncompromising durability.

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Find out about the solution ALTEC offers your sound project, large or small, present or pending. Merely call the nearest ALTEC Sound Contractor (listed under "Public Address" or "Sound Systems" in your Yellow Pages) or write Dept. CE-4. No obligation, of course.

ALTEC Sound Contractor to La Concha Hotel: McKee Electric Inc., Mt. Vernon, New York in cooperation with Sola Electric Inc., Puerto Rico.

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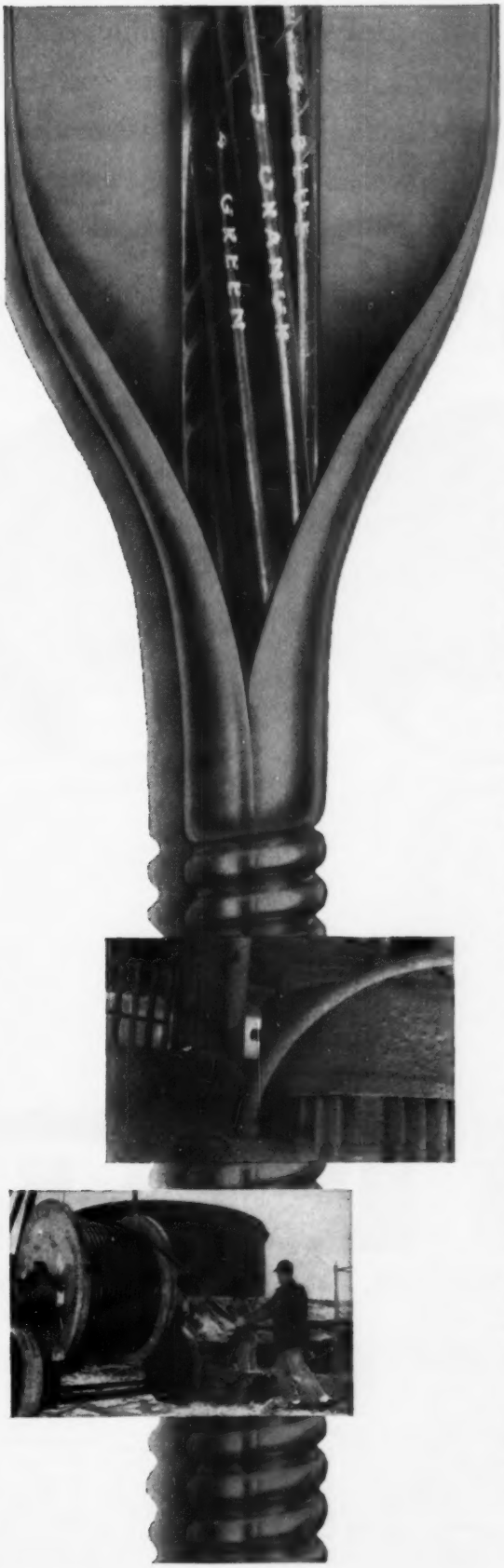

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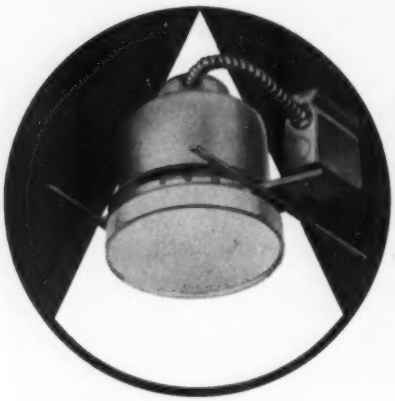

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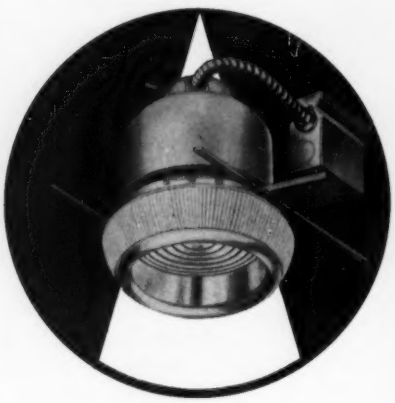

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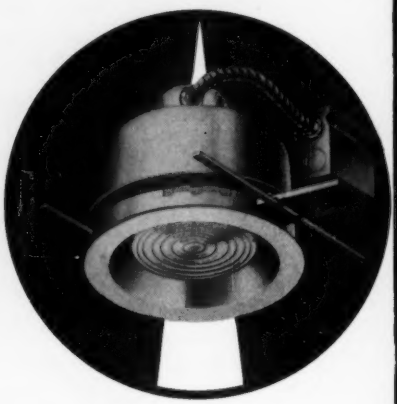

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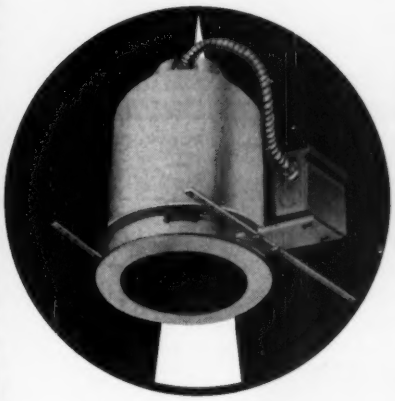

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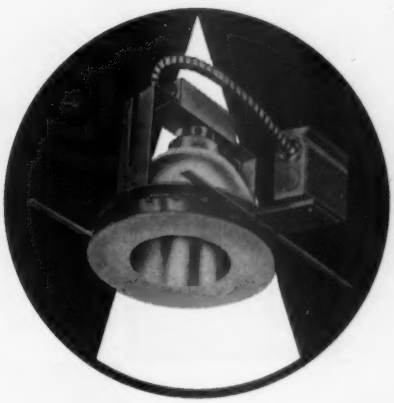

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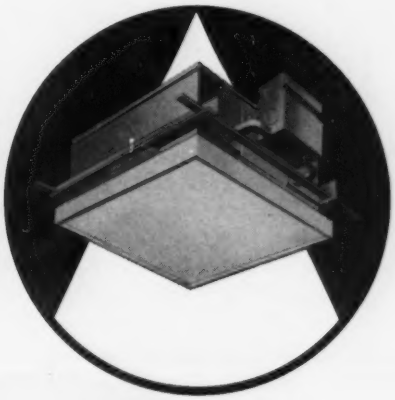

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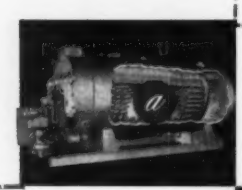

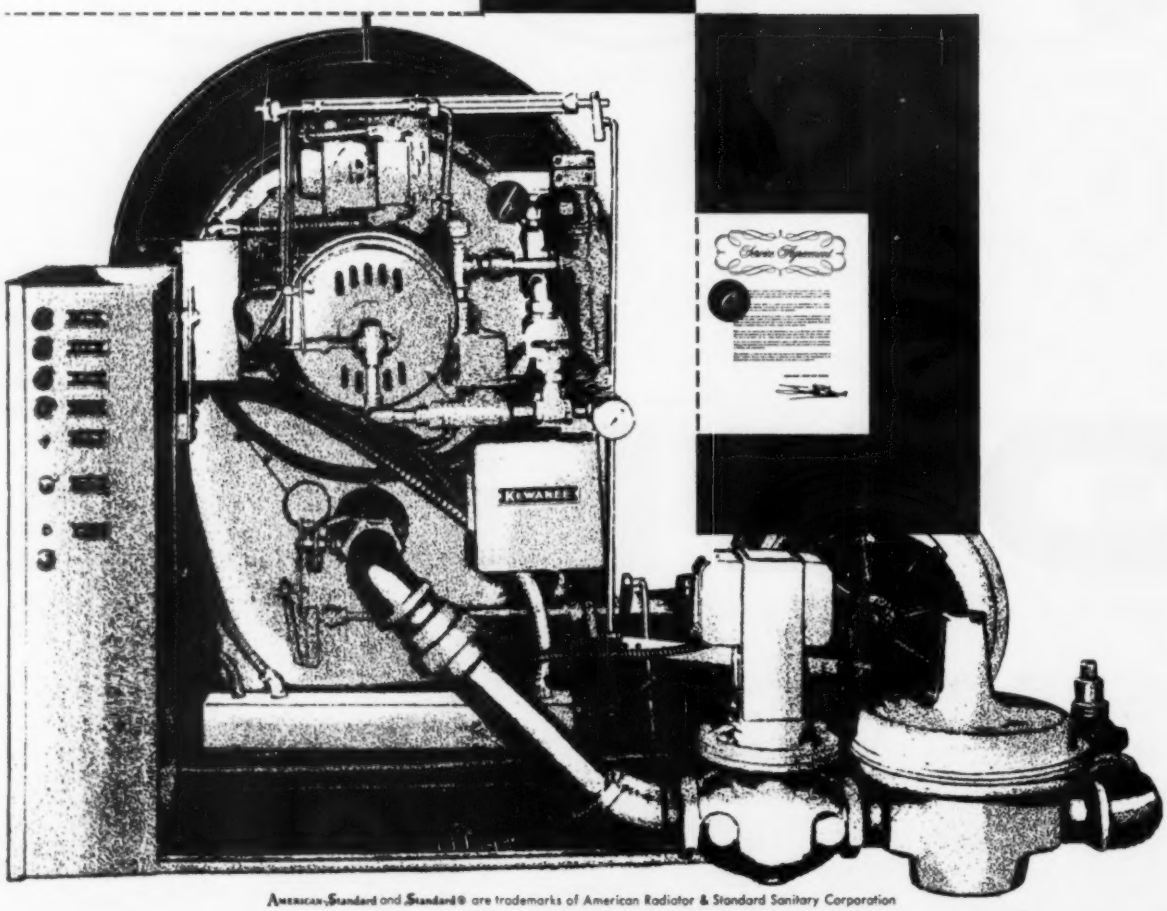

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The Word From Washington

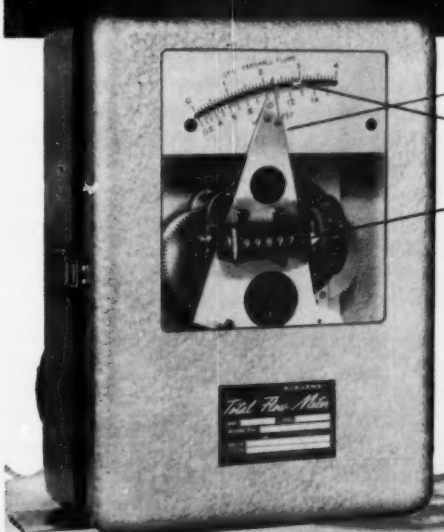
EDGAR A. POE, Consulting Engineer Correspondent

Keogh Bill Makes Progress

The House Ways and Means Committee appears certain of approving the new version of the Keogh bill to provide income tax incentives to encourage consulting engineers and other self-employed persons to establish their own voluntary pension plans. The Keogh measure, in a different form, was passed by the House in the 86th Congress. Subsequently it was altered by the Senate Finance Committee, sent to the floor, and was being debated on the Senate floor at the time Congress adjourned for the two major political conventions last summer.

The newest version of the Keogh bill – officially entitled the "Self-Employed Individuals Retirement Act," embraces a somewhat different approach than was considered in previous Congresses. Instead of allowing the self-employed a limited tax deduction for amounts voluntarily set aside for their retirement, either in restricted trusts or insurance or annuity policies, the new proposal would bring self-employed persons under existing legislation relating to nondis-

STEVENS
TOTAL FLOW METER
Model 60M



Low-cost meter provides essential flow data for operation of sewage treatment plants

- **INDICATES FLOW**—Rate of flow and head are indicated by pointer and scale.
- **INDICATES PEAK FLOW**—Sliding red index on scale indicates peak flow.
- **TOTALIZES VOLUME**—Counter totalizer registers total flow.

Mechanically operated meter provides essential data in measurement of sewage, industrial wastes, irrigation water or other liquids flowing in open channels. Standard meter gives direct flow reading in cu. ft./sec. and totalizes volume in cu. ft. Readings are easily converted to other units of measurement.

The instrument is designed for use with Parshall flumes and various weirs. It is entirely mechanically operated, will function without attention for eight-day intervals, and is easy to install on table, shelf or wall. If a graphic record is desired, the meter can be used with a Stevens Type F Recorder. Write for Stevens Hydrologic Instrument Short Form Catalog No. 23, and for Bulletin 28 which describes the Model 60M meter in detail.

HYDROGRAPHIC DATA BOOK—Valuable reference file, 124 pages of technical data on recorder installations, plus a section on hydraulic tables and conversion tables. $1 copy. (No C.O.D.'s)

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criminatory, tax-favored private retirement plans by allowing them to be treated as their own employers and employees.

The author of the bill, Representative Eugene J. Keogh, Democrat of New York, a member of the House Ways and Means Committee, has long been an exponent of granting self-employed persons tax benefits for setting up their retirement programs similar to those extended to corporate employees.

Legislative Scorecard

There are a series of major bills pending in Congress that affect not only consulting engineers, but just about every man, woman, and child in this country. Some of them will pass, some will never reach the White House for the President's signature.

Here was the picture in March:

¶ A depressed areas bill will become law.

¶ The minimum wage bill probably will pass in a compromise form. Congress will not approve a minimum wage of $1.25 an hour.

¶ An omnibus housing bill probably will pass.

¶ The hundreds of millions of dollars proposed for aid to education will be battled all the way, and could go down in defeat.

¶ Some highway financing legislation will be passed to keep the highway construction program on schedule, or nearly so.

¶ Legislation also will be passed to provide Federal funds to accelerate a program to curb pollution of the nation's rivers and streams.

The Interstate Program

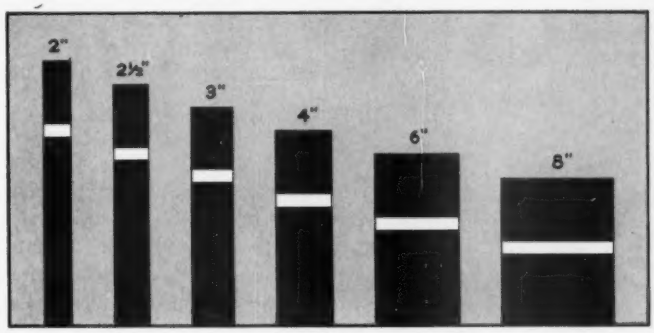
The 41,000-mile interstate system — with its divided, multilaned, stoplight-free highways — will be slowed down unless Congress provides more funds. About $900 million a year more is needed. Therefore, it appears that the Federal gasoline tax, scheduled to be reduced from 4 cents to 3 cents a gallon July 1, will not be reduced. Instead, Congress seems fairly certain of extending the 4-cent tax.

President Kennedy not only is asking that the gasoline tax be extended, but recommends a tax increase on tires, diesel fuel, and trucks over 26,000 pounds.

Unsurfaced Roads Disappearing

The Bureau of Public Roads reports that roads and streets in the U. S., under the jurisdiction of all levels of government, totaled 3.5 million miles in 1958. Compiled from data supplied by the various states, the research showed that rural roads total slightly more than 3 million miles, or 88 percent of the total. The 416,000 miles of municipal roads and streets account for 12 percent of the total.

Observed the Bureau: "The road and street systems in the U. S. have grown little in recent years. The nation's needs lie generally not in more mileage

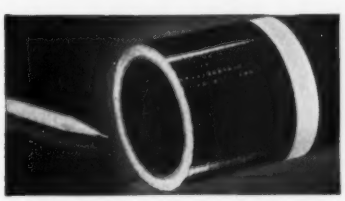


Choose from 6 sizes. Same operating temperature range . . . same operating pressure range . . . same corrosion resistance . . . NEW 6- and 8-inch sizes meet the growing demands of the processing industries.

Now! A complete size range of Fibercast Epoxy Pipe—including new 6″ and 8″

- *handles a temperature range from −65° to 300° F.*
- *withstands an operating pressure range up to 1200 psi.*
- *pipe sizes from 2″ to 8″*

Only Fibercast, with its unique reinforced epoxy resin construction, can withstand sustained high pressures, high temperatures and extreme corrosive conditions more efficiently than any other pipe. Fibercast's ability to competently handle 320 of 338 corrosive solutions is on record. And now Fibercast, in answer to more of the needs of industry, brings its proven value to larger size flow lines.

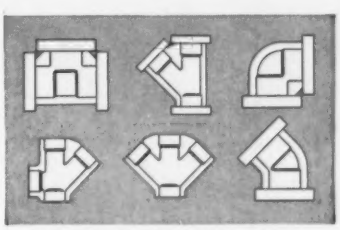


Fibercast Tube and Pipe, ranging in size from 2″ to 8″, is not subject to cold flow or permanent set. It is exceptionally easy to install, readily following ditch contours, saving many costly man-hours where other non-metallic pipes or coated metal pipes simply do not work effectively.

The operating collapse strength of Fibercast is another major factor in its wide-spread use. It has a proven capability of maintaining a collapse load of *twice* the rated collapse!* Moreover, Fibercast is much lighter than steel (less than ¼ its weight) and is correspondingly easier to handle, during both installation and maintenance.

**An additional safety factor is that Fibercast, with its seamless woven glass fiber construction, cannot burst.*

Fibercast Fittings, of course, are also available for the new sizes. They represent the world's most complete stock of standard sizes and types. And, as always, you can have couplings, or even complete piping systems, designed and made to order for your individual requirements.



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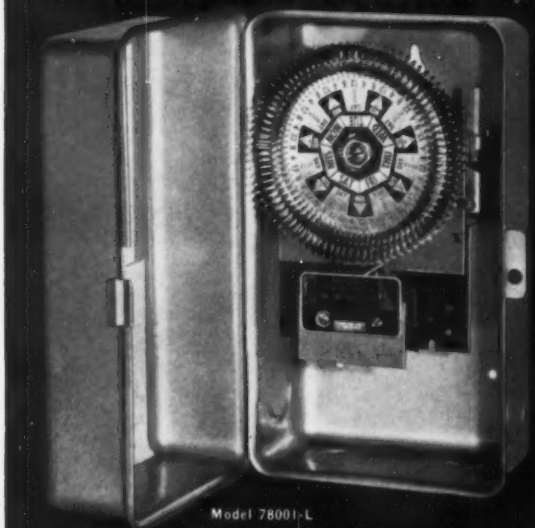

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- Should power fail precision spring mechanism takes over instantly . . . keeps on time for 20 hours!
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- Up to 12 operations a day with 2 hour minimum settings. Dial revolves once a week permitting longer or shorter periods of operation for each individual day, as well as skipping selected days.
- Choice of easy-to-set tab-type tripper dial . . . OR conventional ON-OFF dial!
- Available with Single Pole Single Throw, Double Pole Single Throw, Single Pole Double Throw, and Double Pole Double Throw switching.
- Highest capacity of any 7-Day Time Switch . . . up to 55 Amperes per pole.
- Compact, rugged design . . . same size as 24 hour models!
- Available without case, with bracket . . . or with Flush Enclosure, for panel mounting!

Here is the safest, most dependable Time Switch made . . . designed to meet the highest quality standards of Consulting Engineers and Architects. Insures comfort — no danger of Time Switch failing to operate when needed due to power failure. Economical too! No need for service screws to reset Time Switch after power failure.

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Most Complete Line of Time Switches for Heating, Ventilating, Air Conditioning, Refrigeration, Water Softening, Sewage Disposal, Pumping, and General Electrical Applications.

but in improvement or replacement of existing highways. As one indication of improvement progress, the mileage of unsurfaced roads and streets has been declining at an average rate of 3 percent per year, over the past several years."

More Federal Power?

President Kennedy has declared that the role of the Federal government in supplying an important segment of the nation's power needs will continue during his administration. The power needs of our nation are expected to triple the present installed capacity by 1980. To meet the responsibilities of the United States government, the Administration's power policies include these pertinent points:

¶ Hydroelectric sites remaining in this country will be utilized, and hydroelectric power will be incorporated in all multipurpose river projects where optimum use of the water justifies such action.

¶ The Tennessee Valley Authority will continue to use the financing authority granted it by the last Congress to meet the power needs of the area it serves.

¶ Efforts to achieve economically competitive nuclear power before the end of this decade, in areas where fossil fuel costs are high, will be encouraged through basic research, engineering developments, and construction of various prototype and full scale reactors by the Atomic Energy Commission in cooperation with industry and the utility companies.

¶ In marketing Federal power, the Kennedy administration will give preference in power sales to public agencies and cooperatives, with domestic and rural customers having priority over other consumers. Power will be sold at the lowest possible rates consistent with sound business principles, and power disposal will be designed to encourage widespread use and prevent monopolization.

Who Owns the Patent?

Establishment of a new Federal agency, the "Federal Inventions Administration," is proposed in a bill introduced by Senator Russell B. Long, Democrat of Louisiana. Long said the bill would require the United States government to retain full rights to all technological and scientific achievements paid for with tax dollars. The agency would utilize the government's ownership rights to promote in the public interest "the widest use and knowledge of discoveries" growing out of research done at public expense.

The Louisianian asserts that a long study shows that under some circumstances government departments and agencies, "without authorization of Congress have given to private contractors what rightfully belongs to the public.

"Scientific and technological developments achieved through the spending of public money," said Long, "have become the patented property of private con-

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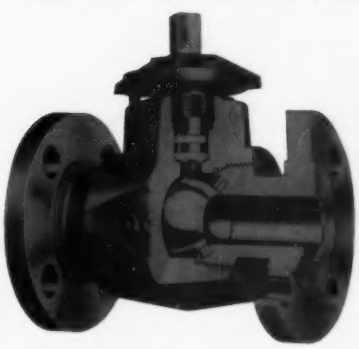

Proved in the laboratory, and in over five years of field service with such difficult ladings as acetone, propane, vinyl chloride, and lime and soda-ash slurry, W-K-M's ACF Ball Valve has earned a reputation for extra long life *without lubrication.* For example —

In one test, W-K-M opened and closed a 2″ standard production model under pressure 600,000 times. The valve still sealed tight, and there was no measurable wear on either the chrome-plated ball or the Teflon seats!

W-K-M's rugged ACF Ball Valves are available in carbon steel to ASA 300 lbs. (some sizes 600 lbs.), and in semi-steel, ASA 200 and 400 lbs. WOG.

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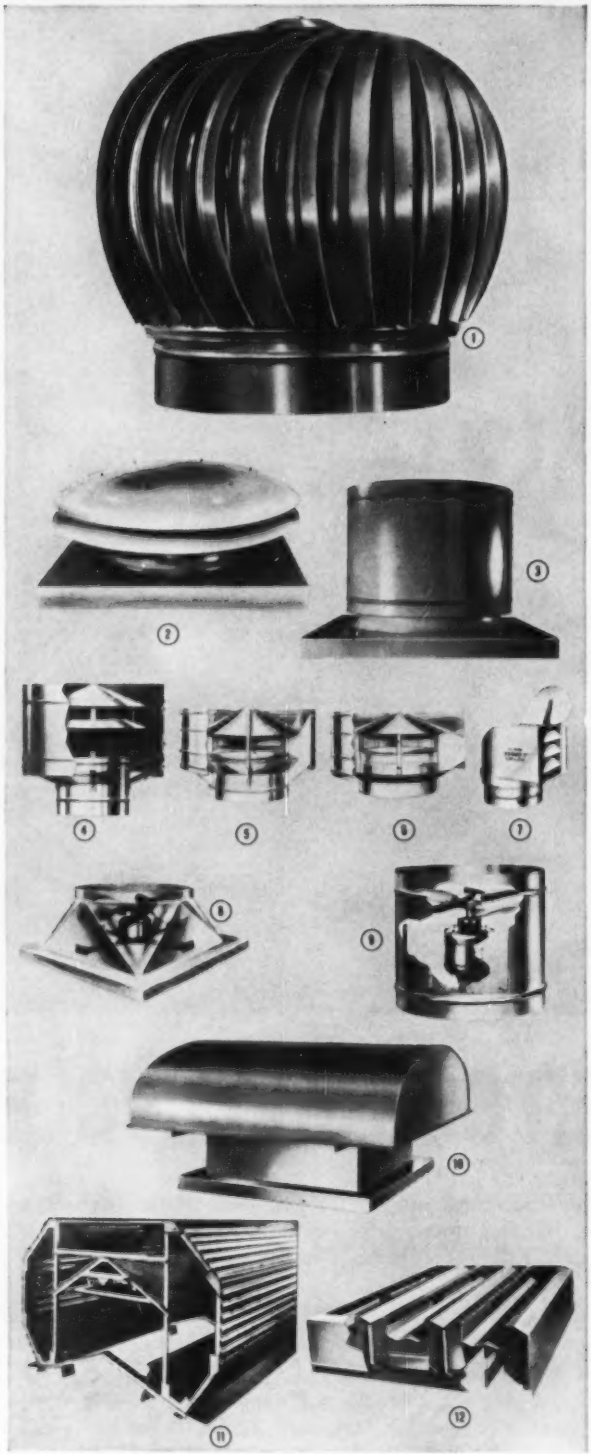

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tractors to be used by them for their exclusive advantage and in conflict with the public interest."

In addition to the bill, Long submitted to the Senate a resolution calling for the establishment of a Senate Select Committee on technological developments for a two-year period.

Water Pollution Control

A member of the House Public Works Committee, Representative John A. Blatnik, Democrat of Minnesota, is sponsoring a water pollution control measure calling for a $1.25 billion Federal outlay over the next 10 years. His proposal also calls for creating a Federal Water Pollution Control Administration.

The measure would increase Federal aid to localities for construction of pollution control facilities from $50 million to $125 million a year. Funds would be allocated to the various participating states on a matching basis.

The Minnesotan sponsored Federal water pollution assistance legislation that became law several years ago. Under his new proposed legislation, responsibility for water pollution would remain with the Department of Health, Education, and Welfare, but its functions and operations would be directed by a new HEW agency. The program currently is being administered under the Public Health Service, which is a part of HEW.

Defense Spending to be Felt

There is apparently no doubt that the nation's defense industry soon will begin to feel the effects of a slow but continuous rise in spending. The Pentagon indicates that the missiles industry not only will benefit first, but most. Aircraft and shipbuilding will follow.

Mounting spending during the four years of the Kennedy administration appears inevitable. Indications are that defense spending for the 1962 fiscal year starting July 1 will be in the neighborhood of $42.9 billion. The current fiscal year, ending June 30, will see spending by the Defense Department totaling around $41.5 billion — considerably more than was estimated by former President Eisenhower.

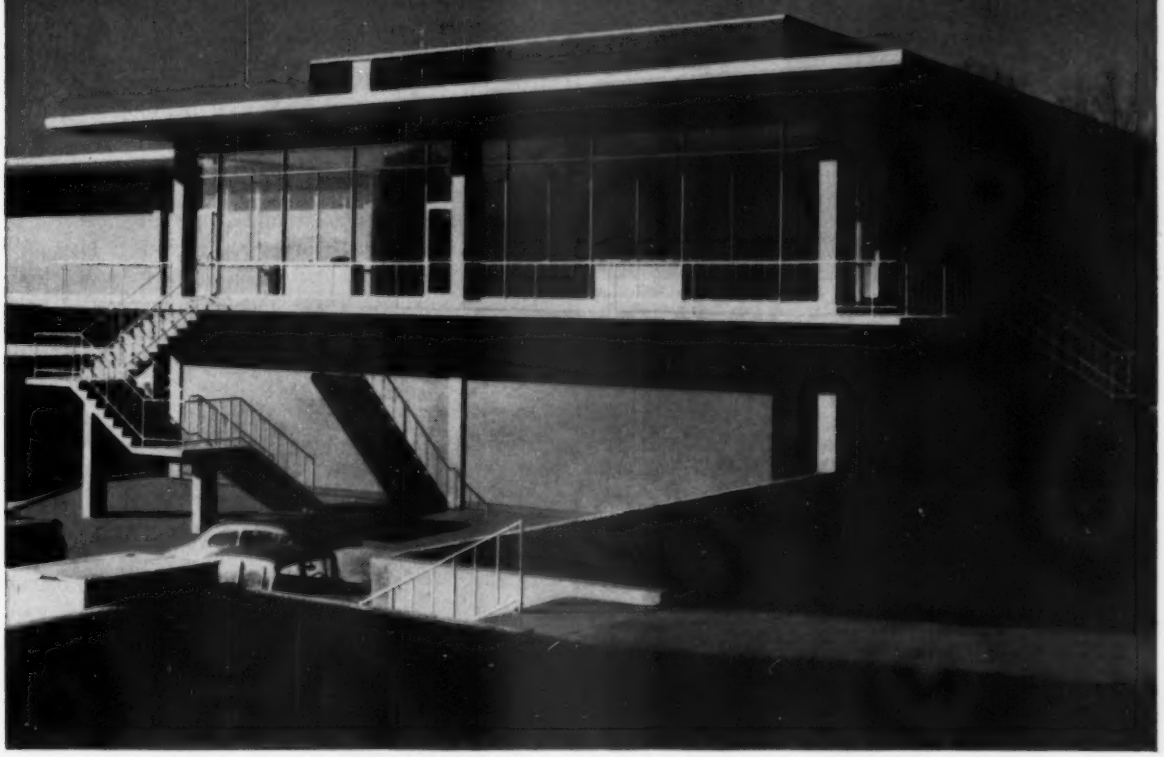
The new administration has called for an expedited program for the Minutemen, Nike Zeus, Polaris, and a number of other missiles.

Small Business Gets Boost

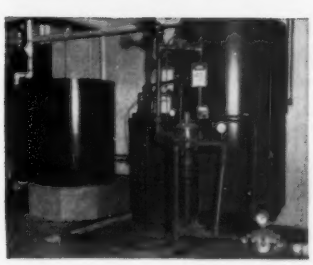
Perennial pressure to give small business a bigger share of defense contracts has suddenly become more than talk. Action, under the direction of President Kennedy, is being taken.

The Chief Executive asserts that the criteria which will make small firms eligible for defense contracts will be increased 25 percent. The administration hopes that this action, coupled with recommendations by the Senate Small Business Committee, will stop the

Fully Automatic Bruner Softener supplies all soft water needs at Washington University's new recreation center



Architects for the Center: Hellmuth, Obata & Kassabaum, Inc., St. Louis Mo.
Plumbing contractor: E. J. Fischer Plumbing Co., St. Louis, Mo.



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steady decline of small business' share of defense spending. This share of total military procurement has decreased from 25.3 percent in 1954 to 16.1 percent in 1960.

The Right to Work

Congress is being pressured by labor unions to repeal Federal "right-to-work" law support in the Taft-Hartley Act. However, the law-makers are, for the most part, fearful that such repeal would open the floodgates for proposals to change the labor law.

The act gives authority for right-to-work laws – a prohibition against forcing workers to join the union. Nineteen states now have the law. The unions may get some administration support for repeal, but it is fairly certain that Congress is not in any mood for a change at this time.

Airport Terminal Buildings

The Federal Aviation Agency has published a guide to the design of airport terminal buildings for cities having scheduled air carrier service. The 86-page booklet, "Airport Terminal Buildings," is aimed at reducing the research required in planning an economical and functional terminal building.

Prepared by the FAA Bureau of Facilities and Materials, the booklet illustrates how passenger traffic activity at a given airport may be analyzed to forecast future passenger volumes. The publication has been designed by engineers and architects to supply important technical information in the form of graphs and drawings. FAA staff members surveyed 57 airports, large and small, in obtaining the information.

Progress on Desalinization

President Kennedy has urged Congress to provide all funds necessary for the Office of Saline Water to broaden and accelerate research on the ocean and brackish water conversion program. At this time, Congress stands ready to approve passage of the necessary appropriation bills.

Meanwhile, there is continued confidence in official government circles in Washington that a way soon will be found to desalt ocean and brackish water into fresh, sweet water at a price that is competitive with what many communities pay today.

The Office of Saline Water thus far has received more than 600 ideas on how to desalt ocean water. Some are good, some are crackpot. OSW is working on a large number of ideas, for it is possible that some obscure approach may solve the problem.

President Kennedy vows that his administration is redoubling efforts to select the most promising approaches to economic desalinization. A panel of the President's Science Advisory Committee is working with the Secretary of Interior to assure a vigorous and effective research and development program. ▲▲

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A TRANTER PLATECOIL consists of two metal sheets, (one or both of which are embossed), spot welded and seam welded together to form channels for heating or cooling media. In addition to standard styles, PLATECOIL offers the design and development of specially formed PLATECOIL to meet specific application requirements.

Thousands of PLATECOIL applications to the heat transfer problems of the processing and manufacturing industries have saved users time and money on engineering, fabricating, installation and maintenance . . . out-performing other types of heat transfer equipment.

"Standard" Style 90 PLATECOIL with exclusive "MULTI-ZONE" design, for optimum steam distribution. Serpentine styles for cooling also available as standard.

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E/R COFAR® with pre-set inserts saves $10.50

$10.50 short cut to a new service outlet...

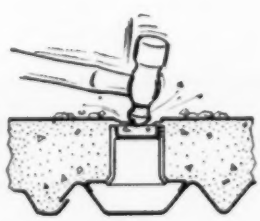
Tap out surface concrete...

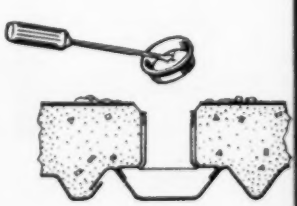
Pry off metal insert cap...

$10.50 worth of tangible savings every time a new service outlet is installed—complete wiring flexibility for the life of the building... that's where the benefits of an E/R (Electrically Ready) Cofar floor system pay off. Optional factory-installed pre-set inserts on the E/R Cofar cells are an exclusive Granco feature. Eliminate concrete drilling. No noise. No dust. Speed installation of service outlets even during office hours. Fast! Clean! Economical!

ELECTRIFICATION, REINFORCEMENT, FORM—E/R is a cellular unit which blends with regular Cofar units to provide complete underfloor electrification, reinforcement and form for concrete slabs. During construction, units serve as a working platform.

DESIGN FLEXIBILITY—E/R Cofar is equally suited to steel or concrete frame construction — for spans up to 14′4″— loads up to 250 psf. Provides 2-, 3-, and 4-hour UL fire ratings.





every time a new service outlet is installed*

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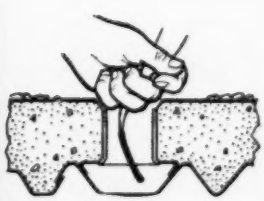

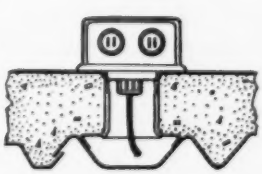

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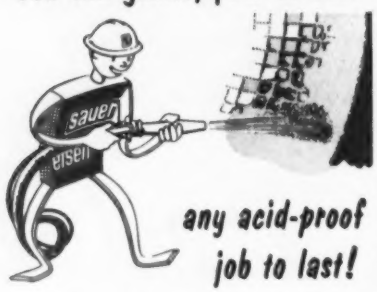

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Men and Firms

Erwin Ga nmeter, a vice president with Paul Weir Company, Inc., consulting mining engineers with principal offices in Chicago, has returned after serving 27 months as head of the firm's coal mining mission in South Korea. A Paul Weir Company team formed the mining portion of a joint industrial group supplying technical assistance to the government of the Republic of Korea. The current phase of the project, designed to increase South Korea's economic self-sufficiency, recently was concluded.

Charles C. Whittelsey, president of Ford, Bacon & Davis, Inc., New York engineering and management consulting firm, has been elected a director of the Ouachita National Bank, Monroe, Louisiana.

Anton Tedesko, vice president of the engineering firm of Roberts and Schaefer Company, New York and Chicago, has been elected to the board of directors of the American Concrete Institute.

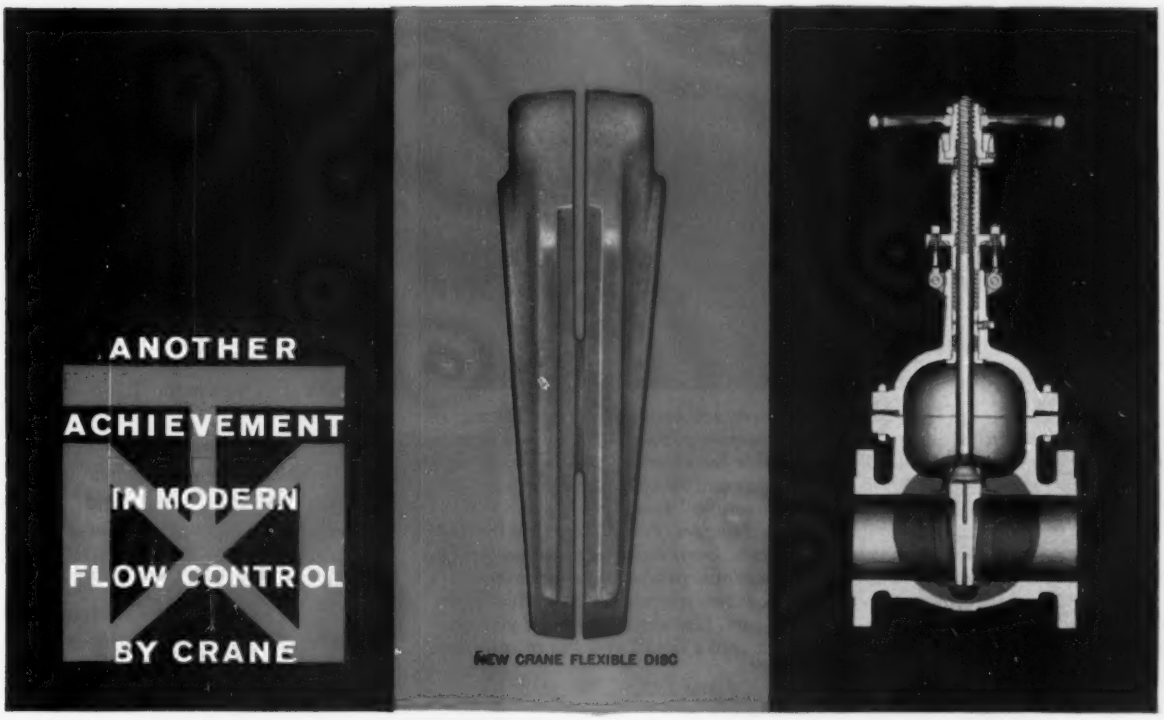
Doctor Sidney Sussman has been named technical director of Water Service Laboratories, Inc., New York City chemical engineers and corrosion prevention specialists. In his new post, Dr. Sussman will supervise the WSL research and development program, relieving Henry L. Shuldener, president of the company, of these responsibilities. Dr. Sussman will continue in his position as chief chemist, which he assumed when he joined WSL.

Robert B. Reed has been appointed manager of program development for Pollak and Skan, Inc., Chicago consulting engineers. Reed will be responsible for helping develop product engineering and design programs with clients.

REED CHRISTENSEN

New officers elected for 1961 by the California Council of Civil Engineers and Land Surveyors are as follows: president, Charles W. Christensen, Freeland-Evenson-Christensen and Boas, San Diego; first vice president, Harold Musser, Maurice-Helmkamp-Musser, Marysville; second vice president, F. William Pafford, Pafford and Associates, Los Angeles; and secretary-treasurer, Aldo P. Savio, Mark E. Thomas & Co., San Jose.

Nicholson, Rothbaum & Davis, consulting structural engineers, of Philadelphia, announce the retirement of Horace B. Nicholson as a



Biggest gate valve advance in 25 years

CRANE FLEX GATES

Instead of being made with a solid disc, new, patented Crane Flex Gates have separate disc faces, connected by the axle-like unit shown in the cross section. This joins the two seating faces, yet provides flexibility for the faces to seat tightly with independent action.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates seat with less torque.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates unseat with less torque... will not stick closed even when closed while hot and allowed to cool.

BECAUSE THEY'RE FLEXIBLE, minor deflection of seating faces due to pipe strains does not affect tightness of Crane Flex Gates.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates are tight on inlet seat and outlet seat over a wide range of pressures.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates can be used singly in some services where two conventional gate valves are frequently specified. You can save substantially on piping costs.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates can be serviced—body seat rings replaced or seating faces refinished—quickly, and without painstaking accuracy. Slightly off-taper seats do not affect tightness or operating ease.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates will easily outperform any conventional solid wedge disc valve you now use. *And there's no increase in price.*

BECAUSE THEY'RE MADE BY CRANE, these new Flex Gates are completely dependable. You can use them with complete confidence on steam, water, gas, oil or oil vapor service. Stem and disc seating faces are Crane Exelloy. Shoulder-type body seat rings are Exelloy or Crane No. 49 Nickel Alloy. Sizes: 12 inch and smaller; 150- and 300-pound pressure classes.

Ask your Crane Distributor for full information on Flex Gates—and for data whenever you work with the products Crane makes. He has the newest in information and products. Crane Co., Industrial Products Group, 4100 South Kedzie Avenue, Chicago 32, Illinois.

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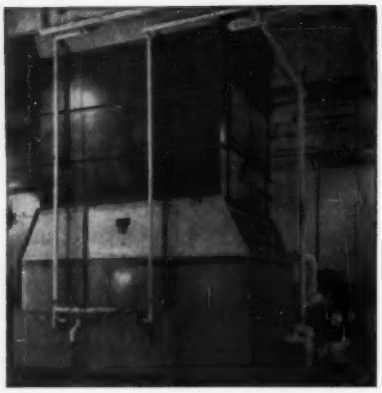

Your Niagara Aero Heat Exchanger sets you free from dependence on a costly cooling water supply and solves the problem of water disposal. It pays for itself quickly and its long-lasting quality and dependability keep it constantly saving money for you and adding to your profit.

This Niagara design also saves you much labor and money in installation and upkeep. Its cleanable coils are easily accessible, as are all interior parts. Its panels are removable for cleaning and painting. It is easy and inexpensive to keep in "new machine" condition.

Niagara Aero Heat Exchangers have been making good records as revenue producers and cost savers for their owners for more than thirty years. Use them wherever you need to cool a liquid or a gas in industry.

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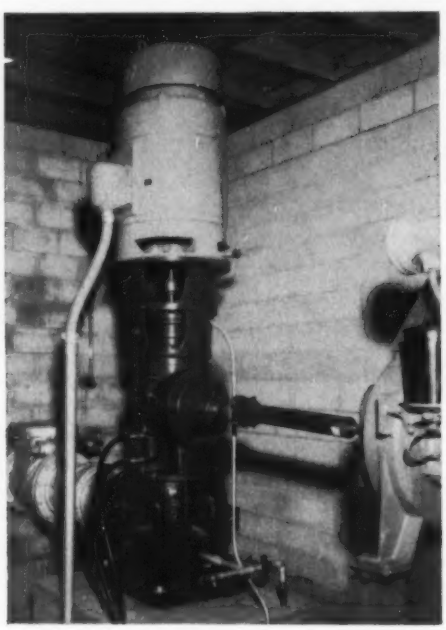

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partner of the firm. Nicholson will be available for consultation to the firm, which will continue its engineering services under the name of Rothbaum & Davis.

Lockwood, Andrews & Newnam, consulting engineers of Houston, Texas, has reorganized and incorporated under the name of Lockwood, Andrews & Newnam, Inc. Mason G. Lockwood is president of the newly incorporated firm and Frank H. Newnam, Jr. is executive vice president. Reorganization resulted in a series of promotions in the executive branches in the Houston headquarters and in its Corpus Christi and Victoria divisions. These included:

¶ A. J. Malloy becomes chief of the civil engineering division with the rank of vice president and director.

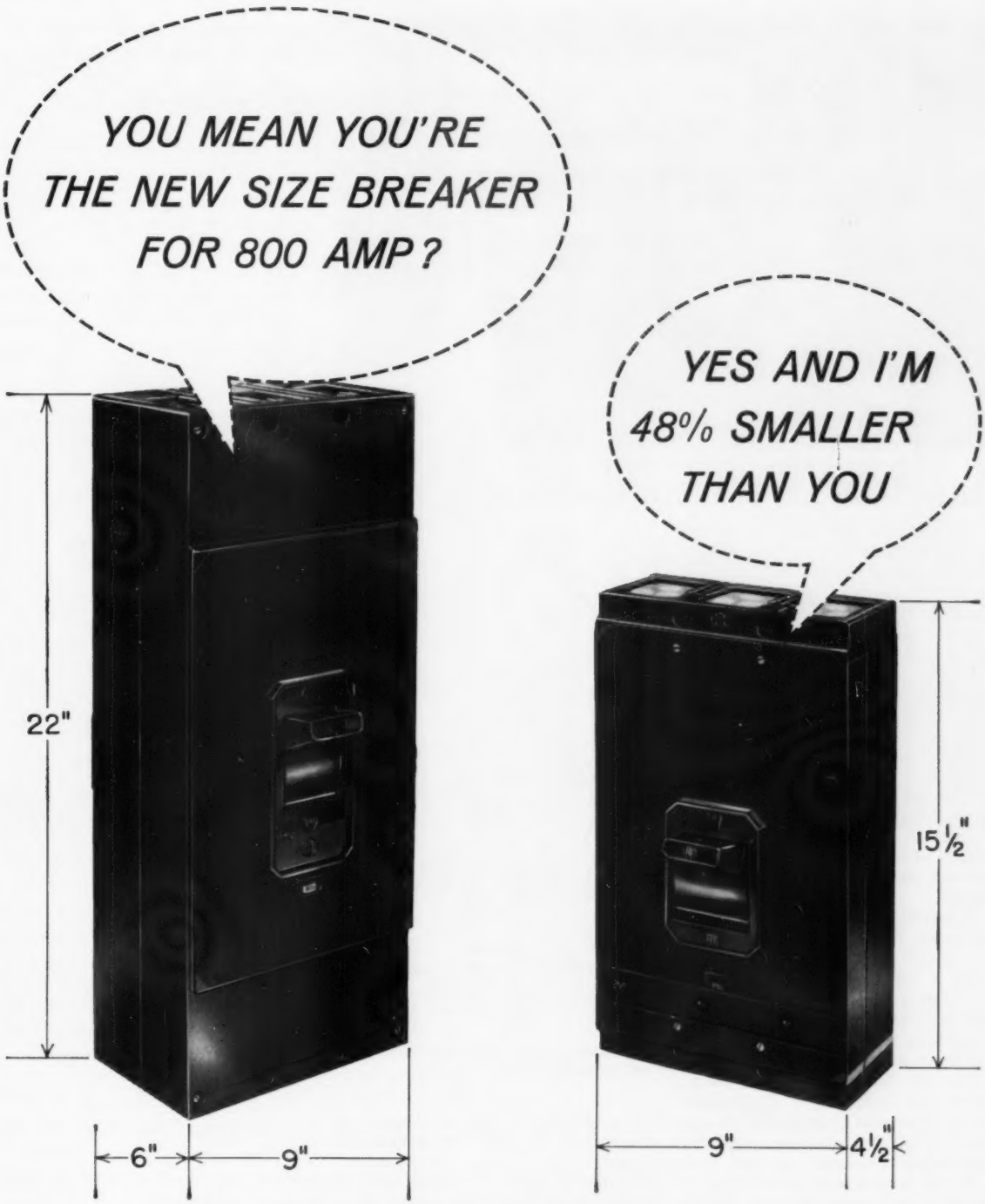
¶ Homer C. Innis was named vice president of the Corpus Christi Division and E. A. Brinkman vice president of the Victoria division. Both were elected to the board of directors.

¶ C. W. Henderson was named chief of the administrative division with the corporate rank of secretary-treasurer and director.

¶ H. L. Murchison was named chief of the specifications and industrial architectural division; Hal K. Puckett, chief of the mechanical and electrical division; and Wallace W. Scherwitz, assistant chief to Puckett. All three were elected to the board of directors.

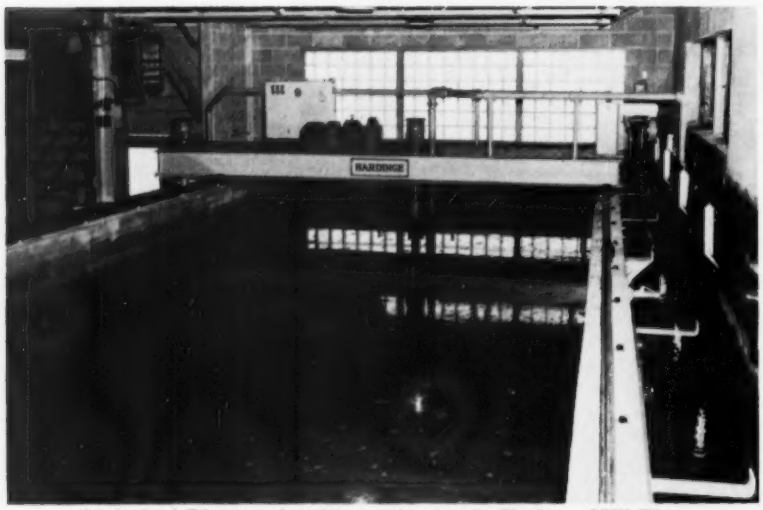
The creation of several departments also has been announced: Pat W. Clark is head of the structural department; D. L. Adair, Jr., head of the civil works department; C. R. Marks, head of the new hydraulic and sanitary department; H. P. Carother, head of the special projects department; and Clarence H. Jones, office manager.

L. E. Lane, consulting engineer of Willmar, Minnesota, and Merwin B. Haase, consulting engineer of Benson, Minnesota, have formed a



You're darn right 800 amperes. Yet this new I-T-E KM frame circuit breaker shaves 6½ in. off the height and 1½ in. off the depth for this rating. Handles 800 amp continuous, 50,000 amp interrupting at 240 volts, 25,000 amp at 600 volts. Send for full details. Write I-T-E Circuit Breaker Company, Dept. SA, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY



Cumberland Filtration plant interior, showing the Hardinge ABW Filter.

ABW SAND FILTER PROTECTS MUNICIPAL WATER

In the attractive New England village of Cumberland Hill, Rhode Island, is located a municipal water treatment plant which, since 1955, has been serving the Town of Cumberland urban district in north Rhode Island.

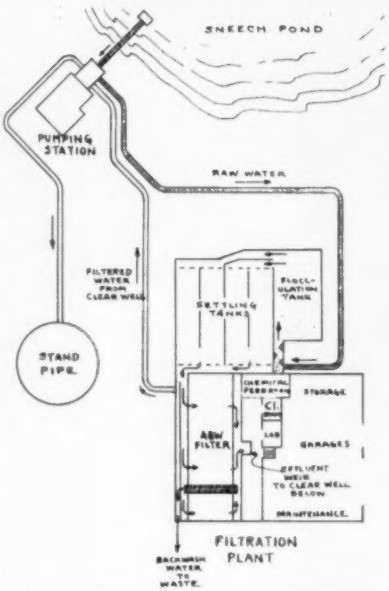
Water from Sneech Pond receives chemical treatment and flows through flocculation and sedimentation chambers where most of the flocculated solids settle by gravity.

The water next flows to a Hardinge Automatic Backwash Sand Filter, in which the remaining traces of suspended solids are removed, producing a sparkling water.

Handling 60,000 gallons per hour of water, the Hardinge Filter bed measures 12½′ wide x 42′ long, with a compartmented sand bed 11″ deep, supported on porous plates. The novel feature of the filter is its traveling backwash carriage, which automatically travels the length of the filter bed, to backwash and clean one compartment of the filter bed at a time while the balance of the filter continues to operate in a normal manner.

Water is processed continuously without shutdown of the filter for backwashing. The filter bed is kept essentially free of sediment, since the latter is removed frequently as it accumulates. Head pressures, therefore, remain low and constant.

These filters, complete with all controls, are available in unit sizes from 500,000 G.P.D. to 5,000,000 G.P.D. Multiple units can provide unlimited capacities.



Schematic flow sheet of Town of Cumberland Water Treatment Plant.

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partnership to be known as Lane & Haase, consulting engineers. Offices are in the Masonic Temple, Willmar, Minnesota.

At the annual meeting of the Consulting Mechanical Engineers Association, Los Angeles, the following officers were elected for 1961: president, Vincent A. Megna, Daniel, Mann, Johnson & Mendenhall; vice president, William F. Escher, Swickard & Escher; secretary-treasurer, Gilbert J. Comeau.

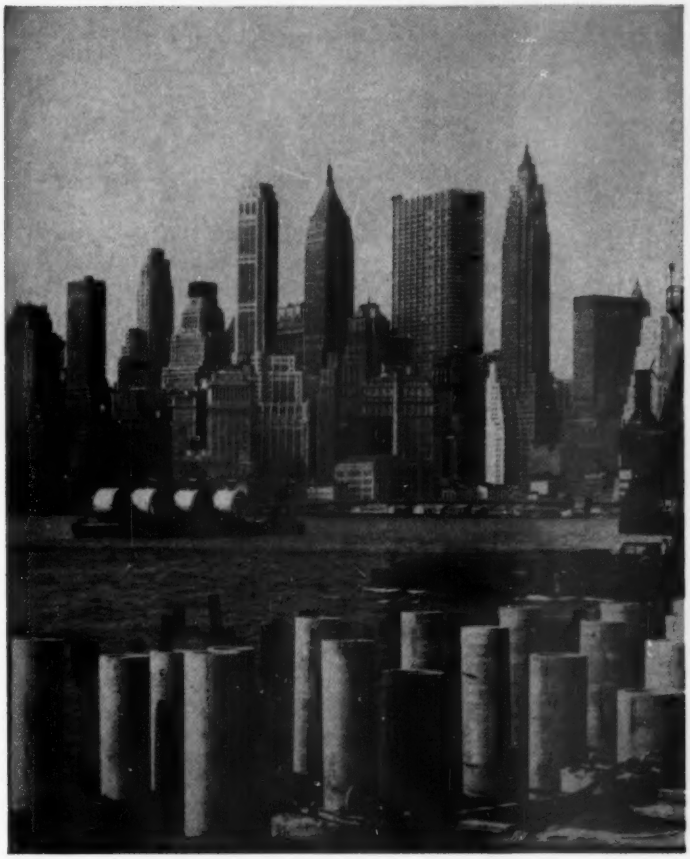
George W. Cumbus, vice president and head of the structural department of J. E. Sirrine Company, Greenville, South Carolina, has retired because of ill health. Several changes in the administrative staff became necessary because of Cumbus' retirement: J. H. Bringhurst, Jr. was named head of the structural department and M. M. Stokely was named first vice president. H. S. Forrester has succeeded Cumbus on the executive committee.

Marvin W. Runyan, Portland consulting engineer, is the new president of the Oregon Section of the American Society of Civil Engineers. A partner in the consulting engineering firm of Stevens & Thompson, with offices in Portland and Seattle, Runyan has been active in numerous organizations and technical societies. At present, he is chairman of the public relations committee of the Consulting Engineers Association of Oregon.

The firm name of Frank H. Walk & Associates, consultants of New Orleans, has been changed to Frank H. Walk, Gerald M. Haydel & Associates.

William H. Byrne, president of the American Society of Mechanical Engineers and head of two New York consulting engineering firms — Byrne Associates, Inc. and Stevens and Wood, Inc. — was the recipient of the Stevens Institute

METROPOLIS OR MOUNTAIN TOP



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15,000 feet up on the bleak slopes of the Andes, the installation of 40 miles of Lock Joint Concrete Pressure Pipe made vital water available to the Southern Peru Copper Company's $300,000,000 mining enterprise.

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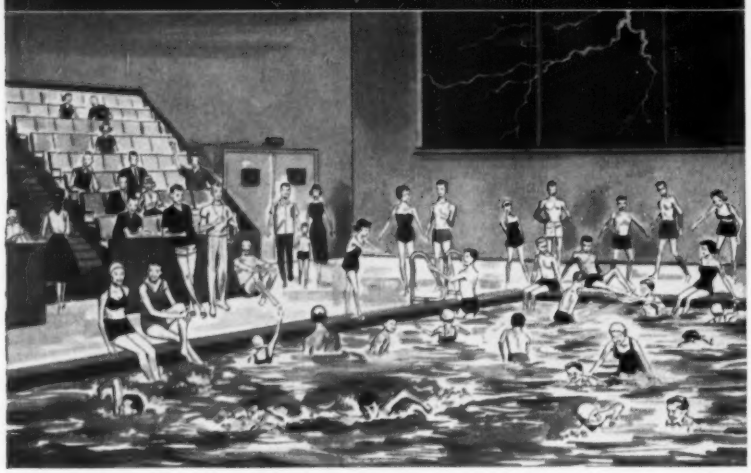

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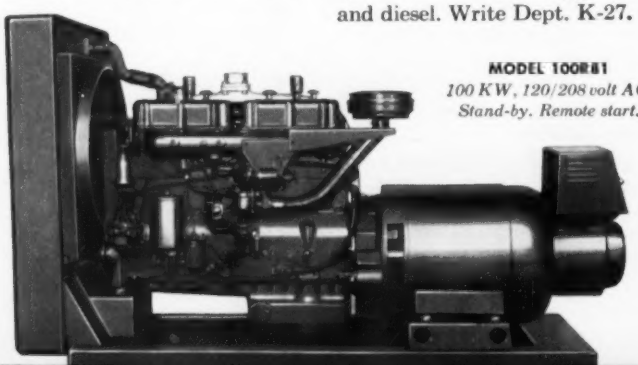

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of Technology Honor Award "for notable achievement in his field." Presentation was made at the annual alumni dinner held recently in New York City.

Shepherd & Worthington, Inc., consulting engineers of Silver Spring, Maryland, announces the association of B. Edward Prescott, Jr. with the firm as chief design engineer, and simultaneously a change in the corporate name to Shepherd, Worthington & Prescott, Inc.

William G. Riddle, until recently a partner in Haskins, Riddle and Sharp, announces the formation of William G. Riddle and Associates. Associated with the firm will be Charles P. Brooks and Ben F. Riggin, professional engineers, and Donald Philco, professional engineer and registered architect. Address of the new firm is the Country Club Plaza at 47th and Belleview, Kansas City, Missouri.

Dr. H. M. Paynter, an associate professor in mechanical engineering at Massachusetts Institute of Technology, is now associated with Charles A. Maguire & Associates, consulting engineers of Providence, Boston, and Hartford, in a consulting capacity. Dr. Paynter's vast academic and practical experience in the application of analog and digital computers to the solution of complex engineering problems is now available to the firm's clients.

Fred S. Dubin Associates, consulting engineers, of Hartford, Connecticut, announces that it will be represented in Philadelphia, at 138 South 20th Street. Desreal Putterman is in charge of the Philadelphia operation.

Harlowe H. Bohn, formerly director of South Dakota Industrial Development and Expansion Agency, has joined the staff of Scott Engineering Company, engineers and architects of Watertown, South Da-

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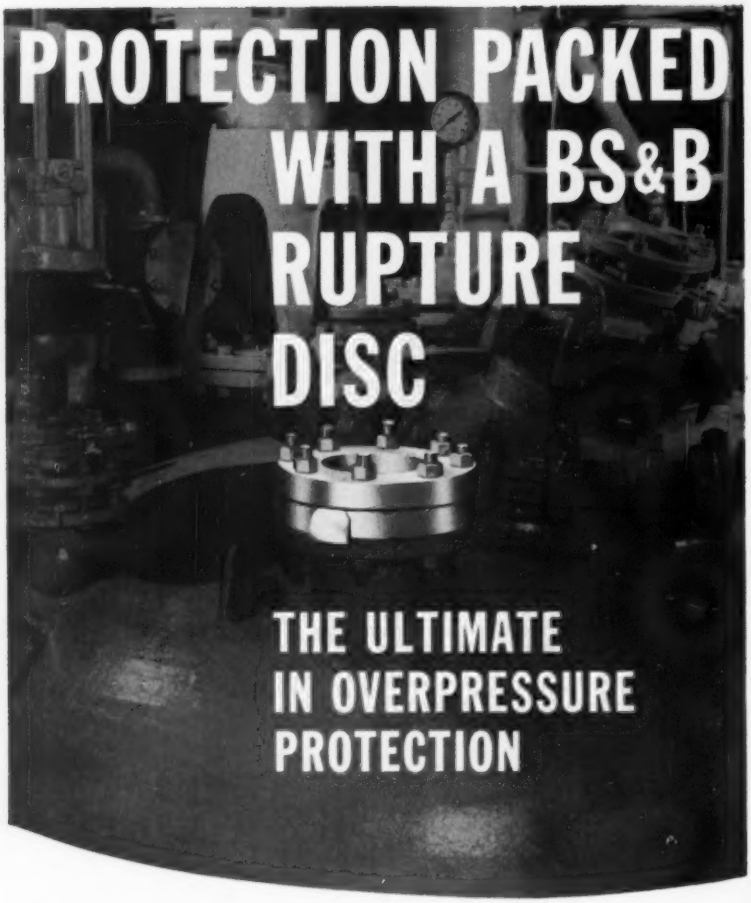

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kota. Bohn will be vice president and manager of the firm's Aberdeen, South Dakota office.

Gerald T. McCarthy, senior partner of Tippetts-Abbett-McCarthy-Stratton, engineers and architects, New York, has been elected president of the American Institute of Consulting Engineers. Also elected were Harold M. Lewis, consulting engineer, New York, as first vice president; and Gilbert I. Ross, partner, Ross & Company, New York, as second vice president. Newly-elected members of the governing council for three years are: David G. Baillie, Jr., partner, Singstad & Baillie, New York; James P. Exum, partner, Howard, Needles, Tammen & Bergendoff, New York; and Howard J. Williams, vice president, Fay, Spofford & Thorndike, Boston.

MC CARTHY WRIGHT

Lockwood, Kessler & Bartlett, Inc., Syosset, New York, engineering consultants, has opened a Washington, D.C. office, with Marshall S. Wright, Jr. as manager. Address of the new branch is 1801 North Patrick Henry Drive, Arlington, Virginia. Other LK&B branch offices are in San Juan, Puerto Rico, and Bogota, Colombia.

Spencer Flournoy has been appointed a vice president of Frederic R. Harris, Inc., New York City consulting engineering firm. Flournoy, formerly assistant vice president, joined the firm in 1953, and presently is project manager of a sea port design project located at Ashdod, Israel. ▲▲

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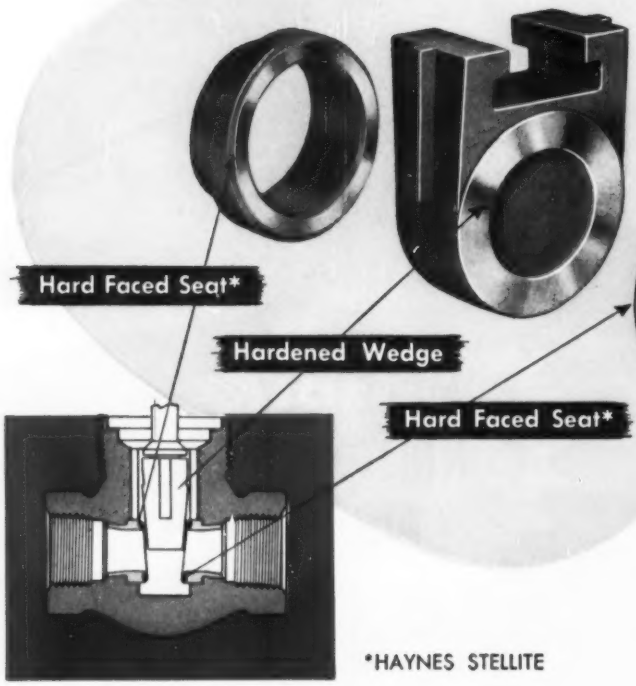

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- Sure-tight, enclosed, E-Z WIRE® Pressure Terminals in rear.
- Just strip and push Wires into Terminals. To release, press down in slot with screwdriver.
- Prevents haphazard connections

- Takes standard wall plates
- Installs in any position

- Feathertouch instant Action. ROCK IT—PUSH IT—TOUCH IT.

- Packaged in Cellophane-Wrapped EAGLE "SHO-PAK"®
- TOUCH-A-MATICS are also available in S.P. and 3-Way; Flush and Interchange types; 15 Amps and 20 Amps, 120-277 Volts AC only. With plaster ears, self-tapping Captive screws.

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NEW ADDITIONS

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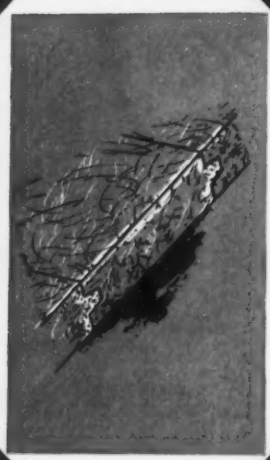
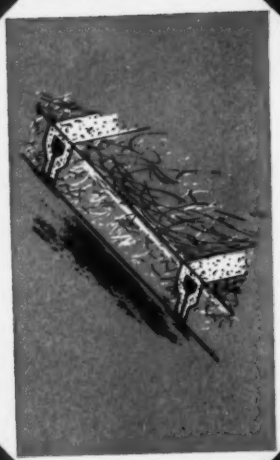
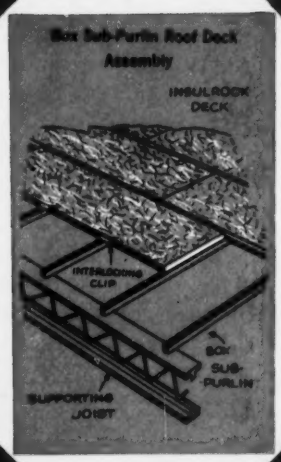
FLINTKOTE INSULROCK® Roof Decks



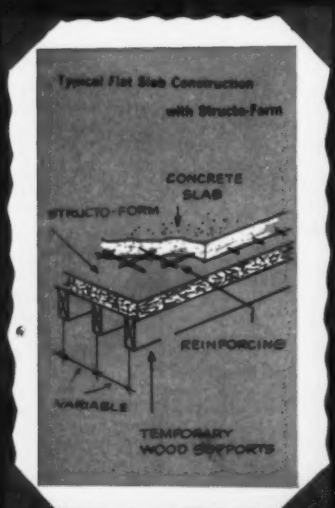
Interlocking Joint. including Painted Bevel, for joist and beam construction aligns roof deck better, installs easier, improves insulation, distributes loads better.



Chamfered Edges of improved Flo-Easy design for subpurlin construction increase resistance to uplift, make for continuous stronger joints.

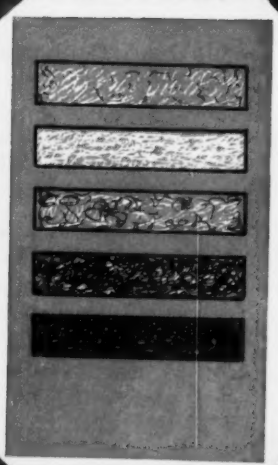


Box Sub-Purlin assembly gives new flexibility to open construction design, reduces costs.



Structo-Form provides uniform, lightweight, strong building planks for flat slab or reinforced concrete construction, producing a handsome finished ceiling.

Insul-Form offers great advantages as formboards in poured gypsum or lightweight concrete decks.

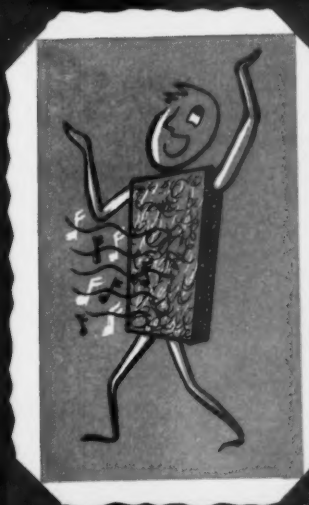


Insul-Tones bring you Insulrock in five striking pastel colors—blue, yellow, green, beige, and pink—an Insulrock exclusive!

...added to the outstanding advantages of regular

INSULROCK *features such as these:*

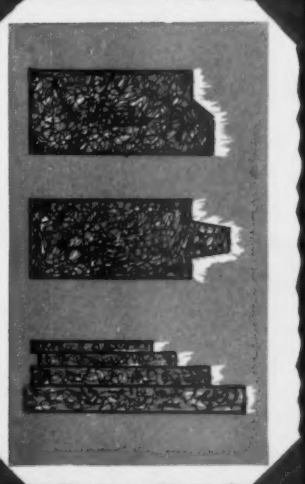
Insulating Insulrock maintains a K factor of 0.51.



Acoustical Insulrock traps up to 85% of incident noise.

Strength & Weatherability of Insulrock protects roof decks against rot, fungi, and termites — strength assured well above ultimate load requirements.

Beautiful Insulrock has random-textured surface with exclusive Insul-Glo 70® finish that makes possible light reflectance of 60-70%.



Special Edge Treatments and Variety of Standard Sizes give you the right Insulrock roof deck for every job.

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INSULROCK DIVISION

FLINTKOTE®

Specify the best deck on the market . . . INSULROCK — for beauty that stands up through the years.

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Parallel Reading for Consulting Engineers

The Seaway Story, by Carleton Mabee; The Macmillan Company, New York, N.Y.; $5.95.

"Much of the Seaway's future is uncertain. It is written in the minds of industrialists who decide where to locate industry, of shippers who choose how to ship their goods, of voters who consider bond issues for port improvement, of engineers who locate highways, of commissioners who determine rail and truck rates, of union members who influence stevedoring and pilotage policies. It depends on the extent to which the St. Lawrence system water is conserved rather than drained away into other river systems. It depends on the initiative of manufacturers in expanding their markets. It is inextricably involved in the future of the economy of the Western world, and indeed of the will to peace of all the nations of the earth."

It is hoped that, with the preceding paragraph, Carleton Mabee has not written the epitaph of the St. Lawrence Seaway. Certainly, such a grand scheme deserves a less "iffy" future.

On April 25, 1959 Queen Elizabeth and President Eisenhower came to St. Lambert, across the river from Montreal, for the formal Seaway opening ceremonies. In the words of the Queen, "We mark the completion of a combined operation that ranks as one of the outstanding engineering accomplishments of modern times . . . It is a magnificent monument to the enduring friendship of our two nations."

Queen Elizabeth was half right, for the Seaway construction is truly a marvel of modern engineering. But it is also a monument to the recalcitrant haggling over petty details which seems to have typified what is essentially a good relationship between the United States and Canada. It would have been better for both nations if Billy Pilgrim had paid Paul Bunyon the $1 million which he agreed

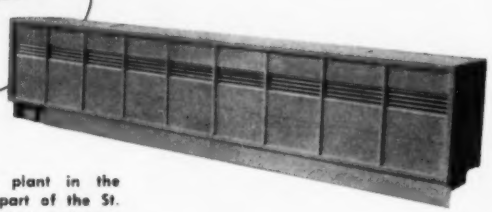
One of the two 380-ton MURCO Gate Hoists furnished to the Power Authority of the State of New York. Each hoist operates a gate 46' wide by 67' high at one foot per minute. These gates divert the water from the Niagara River above the Falls into covered conduits five miles long. The two conduits bring the water to the Niagara Generating Plant on the United States side of the Falls.

MURCO Gate Hoists are designed from knowledge and experience . . . backed by over 75 years in design and manufacture.

. . to divert the water from the Niagara River into covered conduits . . .

MURCO GATE HOISTS

. . to Control Water Level at Long Sault Dam, St. Lawrence Power Project . . .



Write for complete information . . . Engineering Department recommendations . . . when you are planning power dam projects.

For the second largest hydroelectric power plant in the United States at Massena, New York — as part of the St. Lawrence power project — Uhl, Hall & Rich, project engineers, selected MURCO Gate Hoists. Each hoist weighs 93,000 lbs. . . . overall length 57 feet, 8½ feet wide, 12½ feet high . . . lifting capacity of 175 tons and will raise and lower the gates in a dam at a speed of 1 foot per minute.

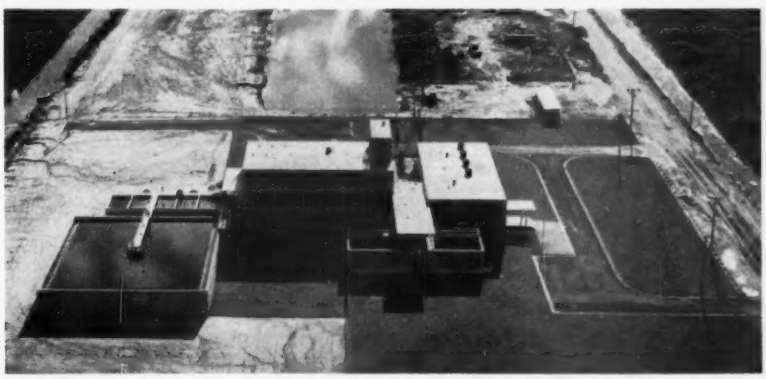
Manufacturers Since 1883

D. J. MURRAY MANUFACTURING CO.

WAUSAU, WISCONSIN

How Johnston Verticals Are Used In An Expandable Water System

The country is growing so rapidly that new utilities must often be made completely "expandable."
Melbourne, Florida, a city of 20,000 twenty-five miles south of Cape Canaveral, faced up to this problem recently and built a spanking new water system capable of handling six times the immediate demand of 2,000,000 gallons per day, with only a small additional investment.



Pumps Are Truly Versatile

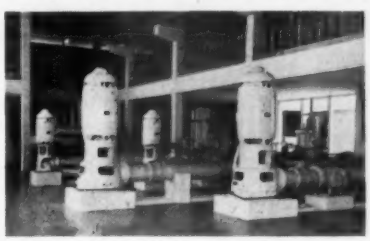
The Melbourne system takes water from the St. Johns River, gravity flows it 1500 feet from the intake structure to a raw water pump well on the shoreline, pumps it another 1400 feet to the plant for treatment, then stores it in tanks from which it flows into a 44 square mile distribution system.

Raw Water Supply

Four single stage Johnstons with weatherproof motors, mounted outdoors on a concrete slab, pump raw water from the intake well to the treatment plant. Two of the pumps with 15 hp. motors, deliver 2 mgd.; the others with 30 hp., have twice the capacity. All operate at 25 foot heads.

Water Treatment and Distribution

Five Johnstons are used for water treatment and distribution, all located on the floor of the pump room. Four are high service units which lift the water to the supply tanks. Two 3 stage 60 hp. units deliver 2 mgd. each at 140 feet total discharge head when operating singly or 160 feet when in parallel.



The other two high service pumps, each 200 hp., deliver 4 mgd. each with a total head of 210 feet singly and 256 in parallel. The fifth unit is a 100 hp. single stage pump which is used to wash the water back through the filter to remove debris. This pump delivers 6750 gpm through the filter at 37 feet head.

Why These Pumps Are So Versatile

These Johnstons perform well under all operating conditions and are designed to handle all types of liquids including several kinds of chemicals and filtering agents. All pumps were made so that the entire column assembly, including the suction bell, can be lifted vertically when the discharge heads are unbolted. Steep-head capacity curve and flat horsepower requirements (see Figure 3) make them economical to operate at all speeds. Capacities can be further increased merely by adding more stages. The pumps are always primed and require a minimum of floor space.

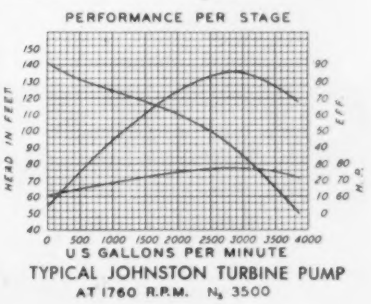


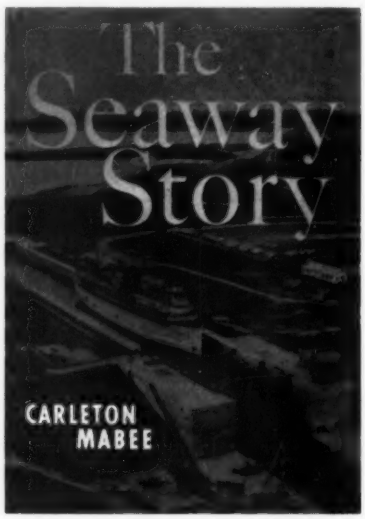
Figure 3

Johnstons have been used by forward looking utilities for over half a century because of versatility, dependable operating characteristics and sound economy. For information on applications, operating data or construction details, contact the main plant, any branch, or nearest distributor. A qualified field engineer will be available for consultation.

JOHNSTON PUMP COMPANY
3272 E. Foothill Blvd., Pasadena, Calif.
Branches:
Pecos, Texas; Roswell, N.M.;
Hastings, Neb.; Idaho Falls, Idaho;
New York, N.Y.; Atlanta, Ga.;
San Francisco, Calif.

was a fair price for the digging of the St. Lawrence. If he had done so, Paul would never have been goaded into creating the Thousand Islands in the Lachine Rapids.

It is unfortunate that, while Canada and the United States both believed in the importance of the St. Lawrence Seaway, they always seemed to manage to do so at different times. Thus, while the Seaway was endorsed by Wilson, Harding, Coolidge, Hoover, Roosevelt, and Truman, its promoters were never able to get it under way until the steel industry got behind it with the discovery of the great Labrador iron ore field. When the United States House and Senate finally got together on May 7, 1954, and passed the Wiley-Dondero Seaway Act, President Eisenhower said, "This marks the end of a long and historic effort." By this time, of course, Canada had decided to go it alone on the Seaway. Thus, she made it very clear that the United States was participating only on Canadian sufferance — even though



Canada had been as recalcitrant in the past as had the Congress of the United States.

The Seaway Story is really the social and political history of the St. Lawrence Seaway. Mabee is fully cognizant of the engineering achievement, but he also recognizes the fact that the engineering works of the Seaway stand as their own monument. Thus, he has gone to some length to tell the story of the high level politicking and promotion that preceded the final acceptance of the Seaway idea. For example, official cost estimates for the final phase of Seaway construction put the figure at $130 million for the United States and $340 million for Canada. It may seem fantastic, but it is a good guess that had the St. Lawrence Seaway been built 15 or 20 years earlier, it could have been financed with the money that was spent in lobbying for and against it.

To many of its proponents, the total tonnage of Seaway traffic has been disappointing. There are serious bottlenecks, particularly at the Welland locks. Meanwhile,

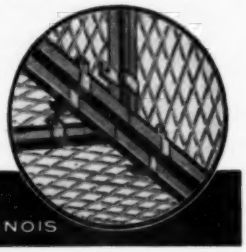
GLOBE SAFE·GARD EXPANDED METAL
(FORMERLY HILMAR)
PARTITIONS with exclusive
QUIK-ERECT patented fittings

...will answer all your enclosure problems

Here is the new, easier, simpler method of guarding conveyors and machines and for all in-plant partitioning. Shipped READY for erection, no cutting, drilling or welding required . . . these interchangeable expanded metal panels provide greater safety, cut overall costs, cover a wider range of use and require 85% less storage space.

EXCLUSIVE QUIK-ERECT SECTION CLIPS save much of the erection time formerly required. Proven successful in hundreds of installations, these Safe·Gard panels are of welded construction, give longer life, are more rigid and stronger than wire, will not ravel or fray.

Note enlarged detail showing SAFE·GARD Quik-Erect Clips securely joining the interchangeable panels.



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HERE'S WHY DURALOX SAVES AS MUCH AS 50% ON INSTALLATION

Clients save time . . . save money . . . save manpower —with Anaconda butyl-insulated Duralox.* *For Duralox has its own conduit of durable, yet flexible, metallic armor.*

This means fast and easy installation in long runs over and around obstructions, in trays, indoors or out—and all without the expense, trouble and time of laying rigid conduit and pulling cable through it.

Duralox will fit into their long-range plans as well—because it's 100% salvageable and can be readily moved as their plant layout changes.

Duralox's lower reactance—because of the close spacing of the conductors—results in reduced voltage drop and more efficient power distribution. Available in ratings of 5 kv, 15 kv, and higher, in addition to lower voltage ratings.

Whether your problem is specifying wiring for a new plant or rewiring an old one—see the Man from Anaconda. Duralox is just one of the many types of Anaconda wire and cable that can help you increase plant flexibility . . . reduce operating costs . . . bring in new power for both today and tomorrow. For full information write for Bulletin DM-5606 to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-CE.

*Reg. U.S. Pat. Off. 61261

Duralox has Anaconda Butyl (AB) rubber insulation
for • extra-high resistance against ozone
• exceptional moisture resistance
• 22% more current-carrying capacity
than 70° centigrade insulation

SEE THE MAN FROM
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FOR BUTYL-INSULATED
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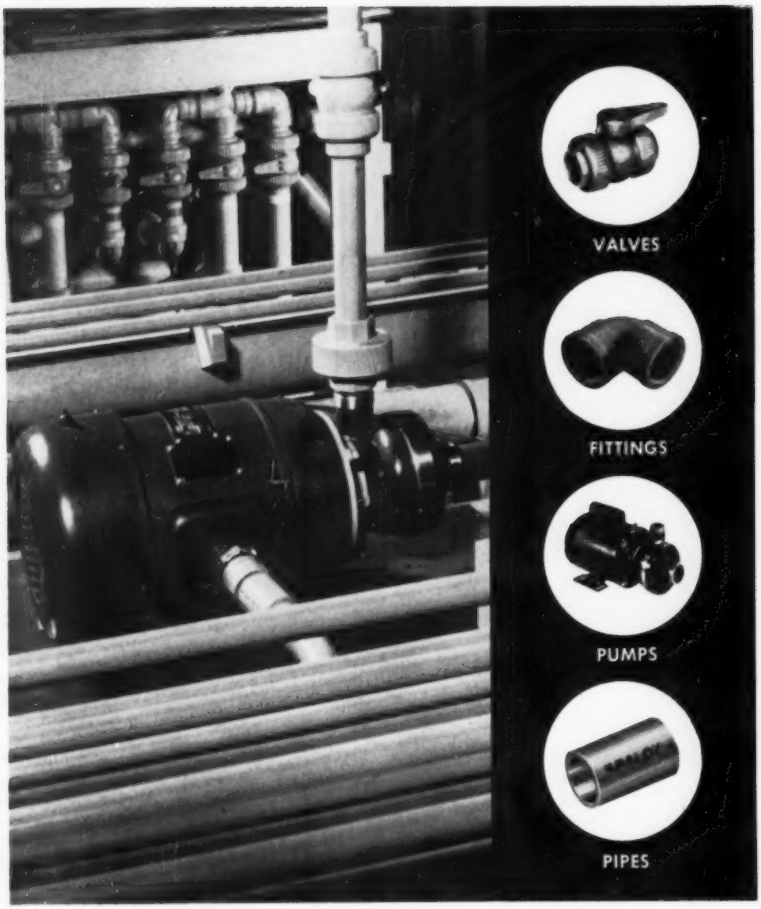

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Valves, pipe and fittings, pumps, and electrical raceways are now available to you from one manufacturer. ■ Here is the advantage of plastic piping and electrical conduit systems integrated in design, manufacture and distribution. ■ Corrosion resistance is only one of the many dynamic features of these modern products. ■ Installation costs are reduced . . . fewer replacements are required . . . and the flow rate of liquids is appreciably increased in plastic piping due to the smooth interior walls. ■ From so many viewpoints these plastic products demand your evaluation. Ask the assistance of your Kraloy/Chemtrol industrial or electrical distributor . . . or write

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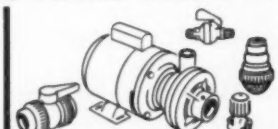


CHEMTROL PUMPS, VALVES AND FITTINGS

there is every indication that tolls will have to rise if the Seaway is ever to become self-sustaining. And there is still the serious obstacle of American railway favoritism to foreign trade through the Atlantic, Gulf, and Pacific Coasts, as opposed to the Seaway coast. There are many problems to be surmounted, but as Mabee says:

"The Seaway will speed the integration of the economy of the United States and Canada, and to a lesser degree the integration of the economy of both of them with that of Northern Europe, to which the St. Lawrence points.

"And in what may be the Seaway's greatest significance, it will encourage the growth of a world outlook in the once isolated center of North America."

•

A Story for Icarus, by Ernst Schnabel; Harcourt-Brace, New York, $4.75.

Earlier in this century, Dixon Wecter wrote a very good book about man's preoccupation with heroes, with supermen. And this might easily have become a century of supermen. There were Kaiser Wilhelm and Teddy Roosevelt and Marshall Foch; later came Mussolini, DeGaulle, FDR, Stalin, and the gigantic Churchill. Good or bad, these were supermen — none of them less than 18 feet tall. Perhaps it's the atom bomb, or perhaps our educational system (a most marvelous scapegoat); at any rate, the world has lost its taste for heroes. The only one left is DeGaulle. Even the race of super-animals that started with Jack London's "Buck" has disappeared — now we have Pogo and Rudolph the red nosed reindeer.

Icarus of the book's title is the lad who flew too high, and drowned in the sea when the sun melted his wings. If we are to believe the author, that was at another time in history when heroes and supermen were going out of style. Daedalus, Icarus's father and the cen-

FROM THE ROOF... THIS CARRIER UNIT CAN HEAT AND COOL A ONE-STORY BUILDING

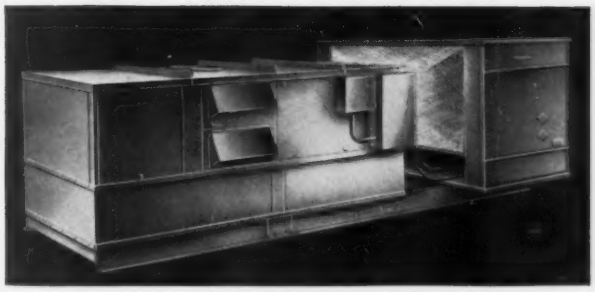
without using any floor or wall space!

Designed for installation on the roof of one-story buildings, this low-silhouette Carrier Air-Cooled Weathermaker* permits complete utilization of floor and wall space. Two capacities fit most heating and cooling requirements—7.5 and 10 tons for cooling; 160,000 and 200,000 Btus for heating. For larger requirements, it can be installed in multiples.

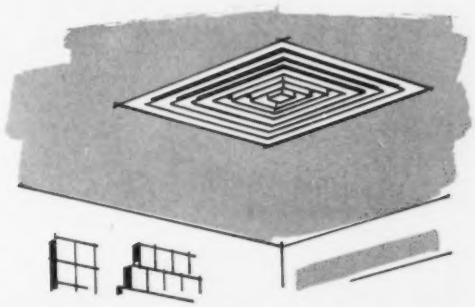
Installation is fast, simple and economical. Expensive ductwork is eliminated, since the unit installs with a single supply and return air duct, thereby requiring only one duct passage to be cut through the roof. Installation is further simplified with only three service connections.

Besides the 48B for heating and cooling, there are two other on-the-roof Weathermakers—the 50AA for cooling only and the 64AA Heat Pump. For information, call your Carrier dealer, listed in the Yellow Pages. Or write Carrier Air Conditioning Company, Syracuse 1, New York.

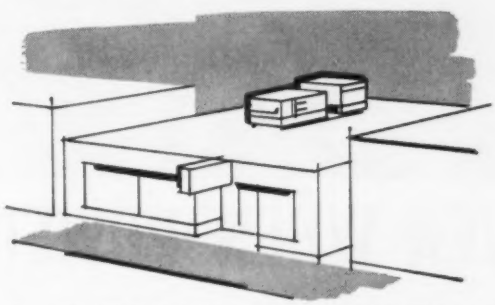
*Reg. U.S. Pat. Off.



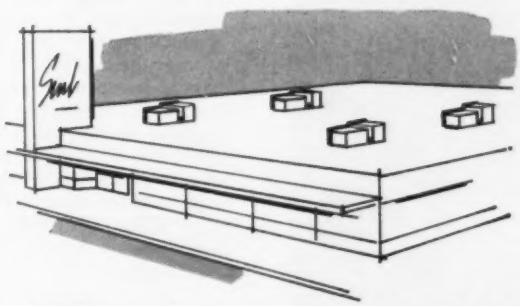
Carrier 48B Air-Cooled On-the-Roof Weathermaker consists of a gas-fired heating section, a fan section and an air-cooled refrigeration section for cooling—all enclosed in a weatherproof casing and mounted on rails. The refrigerant piping is installed and the unit is dehydrated, charged with refrigerant and tested at the factory. Unit is also completely factory wired.



One supply and return air grille fits flush to ceiling—leaves ceiling, floor and walls clear and uncluttered.



A single unit will both heat and cool a small store or plant.

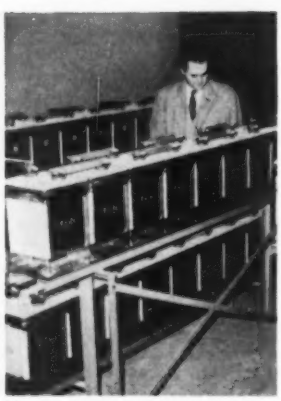


Large buildings require two or more units to heat and cool.

Carrier Air Conditioning Company

How to keep a building lighted

EVEN WHEN POWER FAILS



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What a difference an Exide Emergency Lighting System makes in any building when regular electricity fails. Instantly and automatically, Exide power takes over and keeps lights on—all over the building. This is low-cost protection against panic, damage, theft and injury. It's smart to figure on an Exide Emergency Lighting System when you plan a building. Exide is in a position to evaluate your requirements and impartially recommend either lead-acid or nickel-alkaline batteries. For details, write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

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tral figure of the story, certainly is no hero, and he's proud of it. Daedalus does meet a few heroes, though: Bellerophon, who goes insane; Hercules, who is getting old and punchy; Theseus, who is a lout and a louse. Then, as now, supermen were a dwindling race.

But Daedalus is more than an anti-superman. He is an engineer, perhaps the first one. If we must find fault with him as an engineer, it is that he wastes his time with foolish and useless things. He realizes the folly and the waste, but he's having too good a time to change. In spite of fine work in astronomy, aerodynamics, and structural design, he spends most of his time on toys and games.

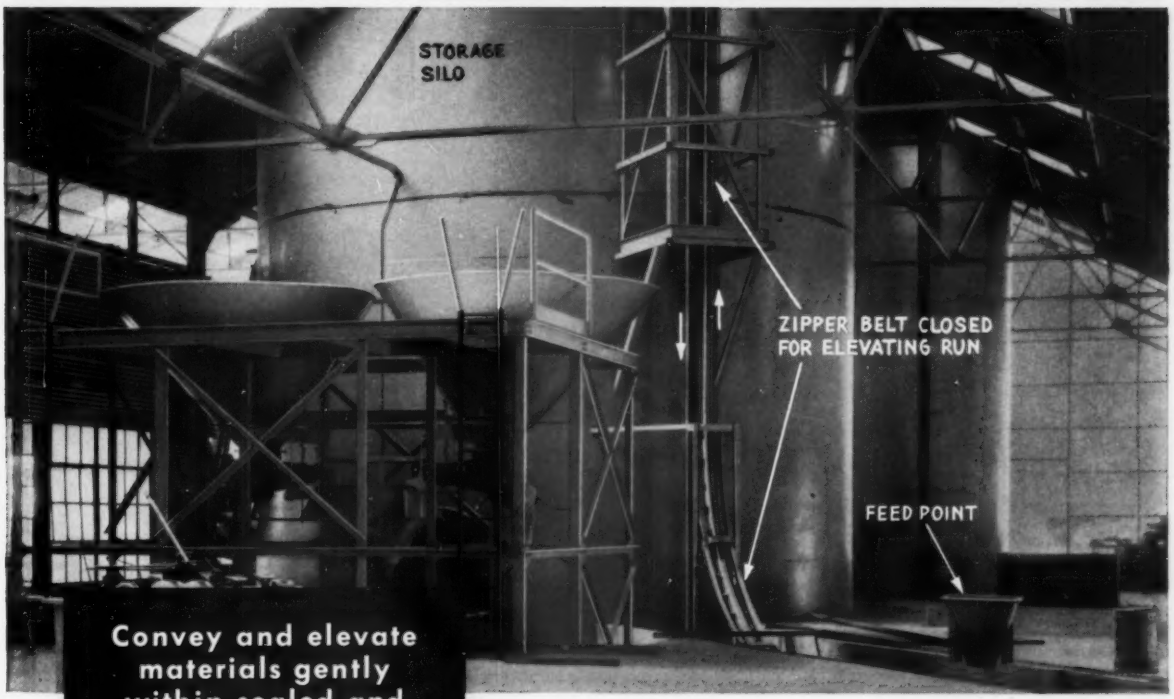
The book has many passages which, in the hands of another writer, could have been major contributions to literature: a drunken dialog in a rowboat in the middle of a fog-shrouded harbor could have been wonderful high comedy; a description of a bull-fight from the bull's point of view might have been profoundly compassionate; and so on. The fault in this may be with the translator. The book was written in German originally, and many passages read unevenly. It is as if the translator had made a perfect English rendition of each German sentence, but had failed to catch the real chain of thought holding together paragraphs and chapters.

•

Elihu Thomson, Beloved Scientist, by David O. Woodbury; The Museum of Science, Boston; $6.00.

Elihu Thomson (1853-1937), according to a *New York Times* editorial in 1916, was an American "of whom the United States will boast hereafter." The editorial added, "he is one of the minds, few in every generation, that produce a great and lasting effect upon national welfare and industrial progress. . . ." About the same time, the *Electrical World* also paid him

STEPHENS-ADAMSON



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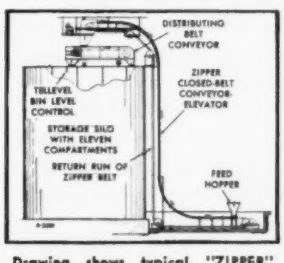
"ZIPPER"

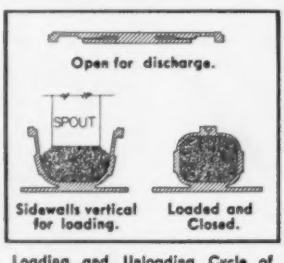
CLOSED-BELT CONVEYOR-ELEVATOR SYSTEMS

Literally a moving material-carrying conduit, the ZIPPER Closed-Belt Conveyor-Elevator is capable of transporting bulk materials in any plane, to considerable heights and around obstructions. Its great advantage is that bulk materials may be conveyed within the belt completely sealed and dust-tight. Material doesn't slide, isn't scooped, pushed or thrown but is gently carried over great distances without breakage, degradation, agitation, contamination, or segregation. A number of materials can be handled without mixing. Abrasive materials can also be handled with the same efficiency. Another advantage is that the ZIPPER Conveyor-Elevator can be easily cleaned out. The ZIPPER Conveyor-Elevator provides versatility of layout and profitable material handling advantages you won't want to overlook.



Drawing shows typical "ZIPPER" Closed-Belt, Conveyor-Elevator installation.

"ZIPPER" Closed-Belt Conveyor-Elevator shown open to receive material at feed point.



Loading and Unloading Cycle of "ZIPPER" Closed-Belt, Conveyor-Elevator.

Upper left, unit closed and loaded. Lower right, belt opened and closed by system of ball bearing rollers.

Write for Bulletin 349

S-A
ENGINEERED BULK HANDLING SYSTEMS
MATERIALS HANDLING PRODUCTS
SPEEDWALK® PASSENGER CONVEYORS
ROLLMASTER® BALL BEARING UNITS
SPHERCO® BEARINGS & ROD ENDS

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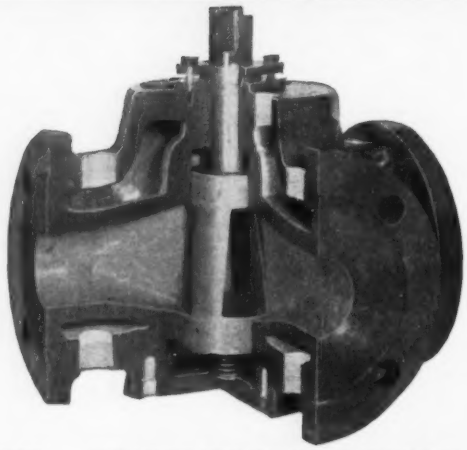

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H & B's fully jacketed spring loaded plug valves feature an inverted tapered plug inserted and lapped into the housing from the bottom of the valve—then spring loaded. The spring wedges the plug to a perfectly tight seal, eliminating troublesome leaks. Easy to operate—no big handwheel . . . no freeze . . . no "breaking loose" necessary. Easy to clean. Made in straight, angle, or multi port design.

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a great tribute in naming him one of a handful of great men in 19th-century science. Only the names of Michael Faraday, Lord Kelvin, and Clerk Maxwell stood higher than his. Other honors he received included the Hughes Medal of the Royal Society of Great Britain; the Franklin Medal of the Franklin Institute; and the Faraday Medal of the Institution of Electrical Engineers. Elihu Thomson, in the opinion of his contemporaries, was a great engineer and scientist.

However, it would be a rare and well-informed American who could identify Thomson today, despite his development, in 1879, of an excellent three-coil arc-lighting dynamo; his invention of electric welding; and his pioneer work in alternating currents. All told, six hundred and ninety-two patents stand in his name.

Thomson deserves to be remembered not only for his technological and scientific contributions, but also for the life he lived. He rose, in the great 19th-century tradition, from poverty and obscurity to wealth and fame. Born in Manchester, England, Elihu was brought to America in 1857 when his father — a mechanic-engineer — ran onto hard times. The family lived in Philadelphia, in a rough and ready neighborhood crowded by factories and warehouses.

Elihu was a precocious lad, carrying on scientific experiments at

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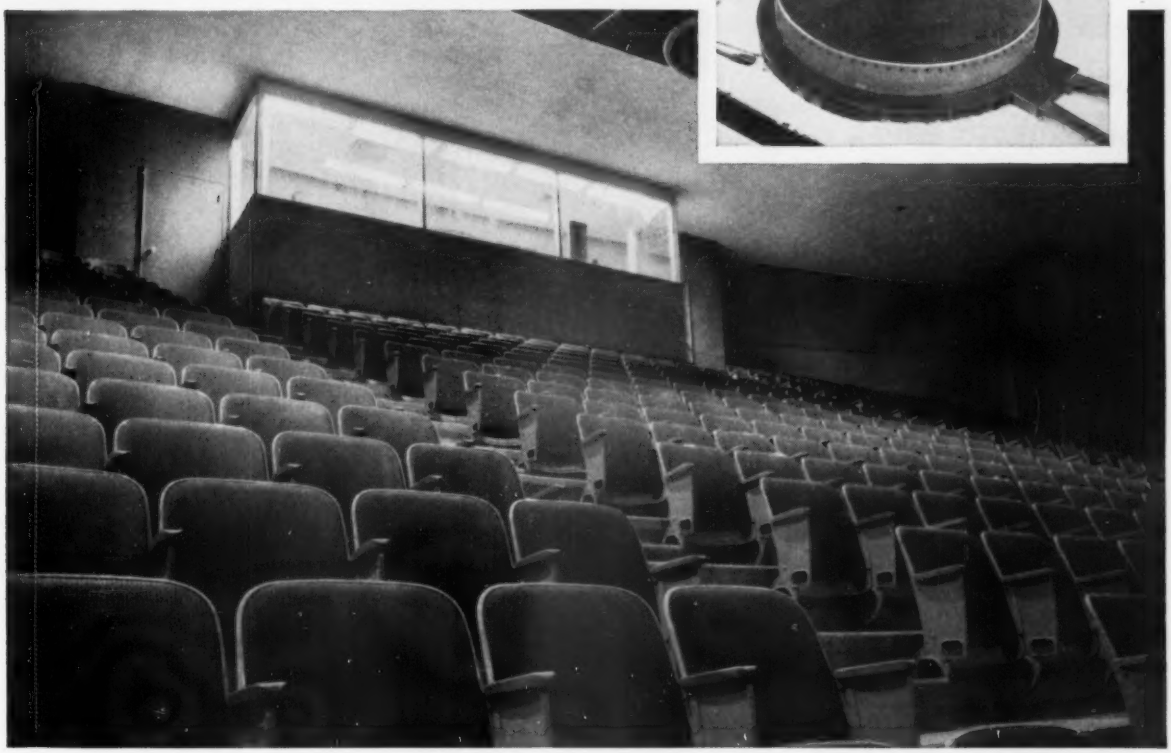
Saint Joseph, Michigan

Stereo sound reproduction and reinforcement, private internal telephone communications plus a complete paging network are combined in a single system at the new Utica Memorial Auditorium, Utica, New York. Architects: Gehran & Seltzer of New York City. Associate Architect: Frank C. Delle Cese of Utica. Consulting Engineers: New York City office of Fred S. Dubin Associates. Installation by W. G. Brown Sound Equipment Corp., Syracuse, N. Y.



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- Permits versatile control and programming such as tape, broadcast, or records.
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- Provides choice between selective area or overall paging network.

Stromberg-Carlson is the *only* audio manufacturer who can offer a complete, versatile line of components—from telephone and loudspeaker intercom system to stereo high-fidelity auditorium equipment.

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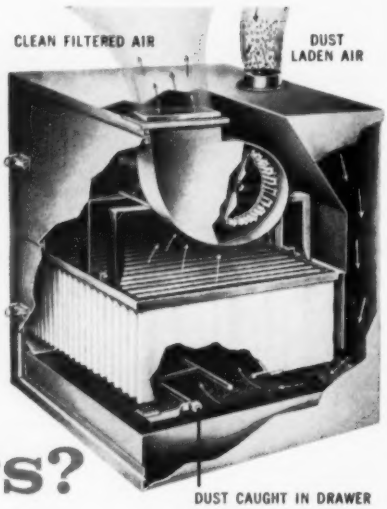

Clean machines hold close tolerances *better* and *up to 80% longer*. Result: a measurable saving in both the cost and frequency of servicing and maintenance work. You can protect your client's plant and equipment investment, help reduce potential production breakdowns, by specifying TORIT Dust Collectors. In the cabinet type (illustrated by cutaway drawing) filters are rated 99.99% efficient by weight on particles as small as ½ micron! Compact Torit high efficiency cyclone and cabinet type units are designed to save space, install anywhere. Your Torit representative will gladly give you dust collector specifications, performance charts, dimensional drawings and installation suggestions. Write:

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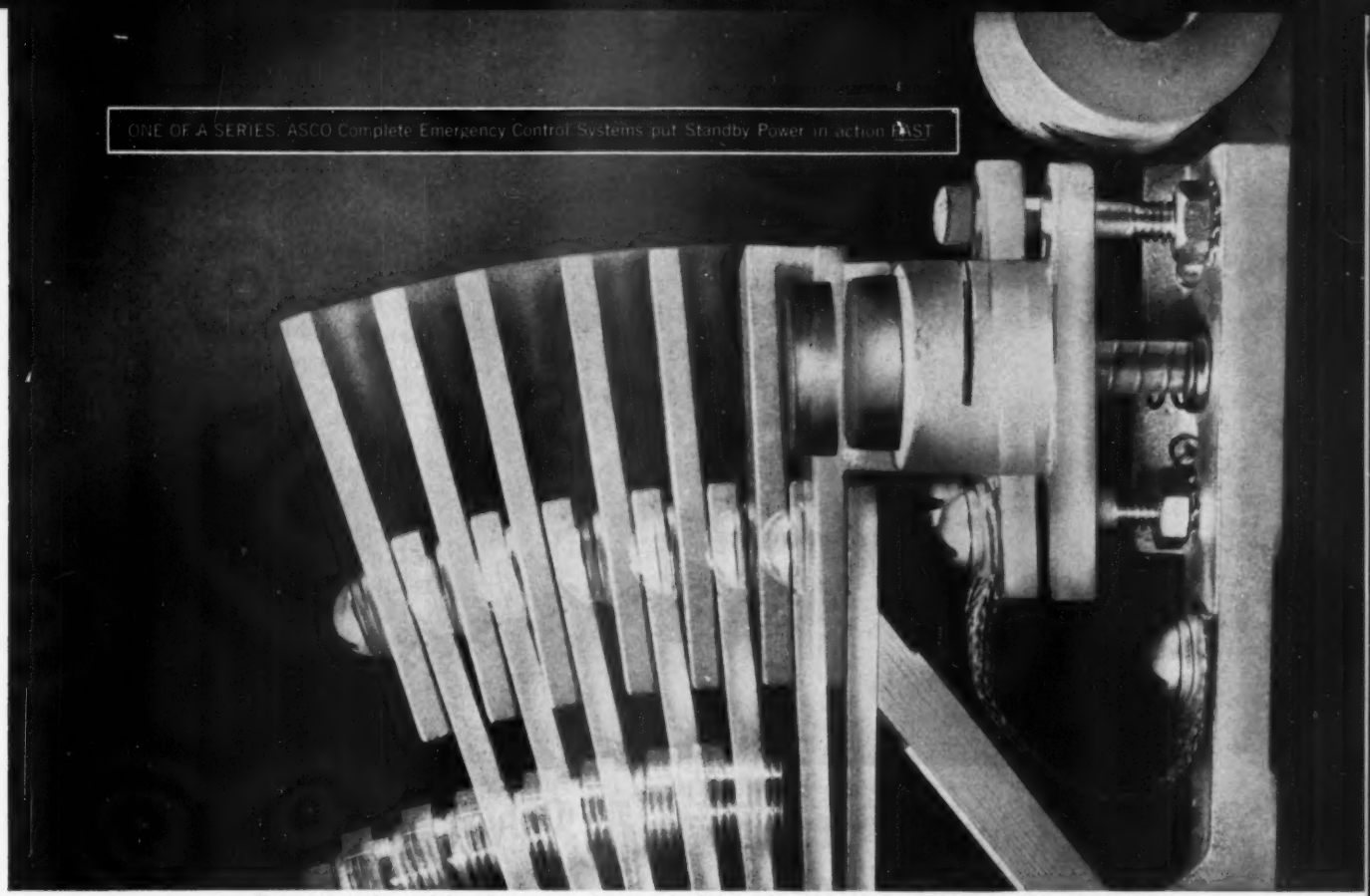
a tender age and astounding his teachers with his brilliance and diligence. He organized discussion groups in imitation of the science lectures popular in his time, and he built a static electricity generator at the age of twelve.

When he was 18, he found a channel for his drive and intellect as a teacher of science at Philadelphia's distinguished Central High School. Also teaching at the Central High School was Edwin Houston, who had won something of a reputation in electricity and physics as a result of his publications. Thomson and Houston agreed to collaborate in their scientific work. The union produced many distinguished inventions and discoveries — and several misunderstandings on the part of the collaborators. In 1876, Thomson won public recognition in his own right, and demonstrated a genius for lecturing. He gave a series of five Winert lectures, on the broad subject of electricity, at the invitation of the renowned Franklin Institute. Though only twenty-three years old, he was greatly pleased "not to discover any vacant seats at any of the five lectures."

Thomson began, in 1878, a series of experiments with dynamos — experiments stimulated by the increasing public use of Charles F. Brush's arc-lighting system. Then a local manufacturer commissioned Thomson to build an arc-lighting plant in Philadelphia. Next, good fortune brought Thomson's work to the attention of a group of New Britain, Connecticut, capitalists, who decided to back him and market his lighting system. This was within months of another distinguished American's invention of a practical incandescent lamp. Thomson, incidentally, publicly belittled the future of Edison's light.

As has been the case with many inventors, Elihu Thomson did not find the policies of his financial backers altogether satisfactory, but circumstances again worked to his advantage when, in 1882, another



Separate make and break contacts insure absolutely clean current carrying contacts at all times.

ASCO Automatic Transfer Switches transfer load in 1/30 to 1/6 of a second

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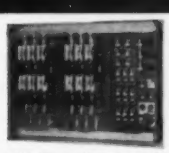
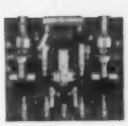
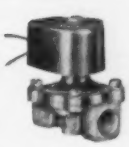


Automatic Transfer Switches *for all classes of load to 750 volts AC-DC. Transfer connected load to standby power when failure or substantial reduction occurs. Return load automatically when full power is restored – in sizes from 10 to 1200 amps. Write for Catalog 57-S1.*

Automatic Engine Starting Controls *provide fully automatic starting and stopping of diesel or gas engine driven generating sets. Write for Catalog 57-S6.*



Load Demand Controls *automatically start engine when load is applied; stop it when load is removed. Write for Catalog 57-S6.*



Solenoid Valves *for air starting applications, and for controlling the flow of cooling water, fuel oil and other liquids and gases. Write for Catalog 25.*

Battery Chargers *are designed for heavy duty industrial use. Provide power to keep engine generator cranking batteries fully charged. Charger can be combined with automatic transfer panel for compact, single package arrangements. Write for Catalog 57-S6.*

PRATT Rubber Seat Butterfly Valves Have Adjustable Seat

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group of investors decided to take over Thomson and his arc lighting system in order to manufacture and market it on a larger scale. Among the group was Charles A. Coffin, who played the most significant role in expanding the Thomson-Houston Electric Company until it merged with the Edison enterprises to form General Electric in 1892.

The account of Coffin's managerial and financial wizardry, however, is not the subject of the *Beloved Scientist*. After Thomson's lighting system became the heart of a big business, the inventor began increasingly to manifest another aspect of his character. He maintained his association with the electric company that he helped to found, and played a highly significant role in making technical decisions and in the contribution of his inventive skill. But he found increasing satisfaction in the role of elder statesman, delineating broad lines of company policy, stimulating younger associates by teaching and example, and, most important, pioneering on the frontiers of science. Unlike Edison, he was not driven to maintain the level of his inventive output.

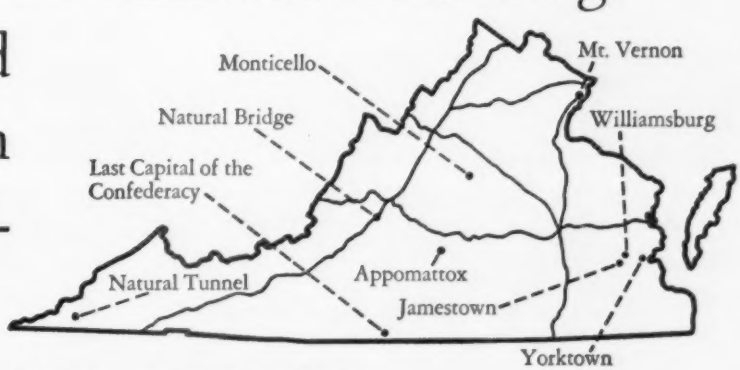
New Technical Books

E. I. T. REVIEW, by V. M. Faires and J. O. Richardson; Prentice-Hall Inc., Englewood Cliffs, New Jersey; $9.00. This book is intended as a review for those taking state registration examinations for engineer-in-training or professional engineering licenses. Typical problems are given.

LECTURES ON COMMUNICATION SYSTEM THEORY, edited by E. J. Baghdady; McGraw-Hill, New York; $12.50. The contributors to this book are among the foremost electronic experts in the country. Their collected work here, in 23 chapters, is intended as a framework for establishing a discipline to cope with problems of the future. ▲▲

In the 1780's it took Thomas Jefferson's coach-and-four about five days to travel the 100 miles from Richmond to Alexandria, Va. Today it takes about two hours. The difference is modern horsepower and 100 miles of four lane highway.

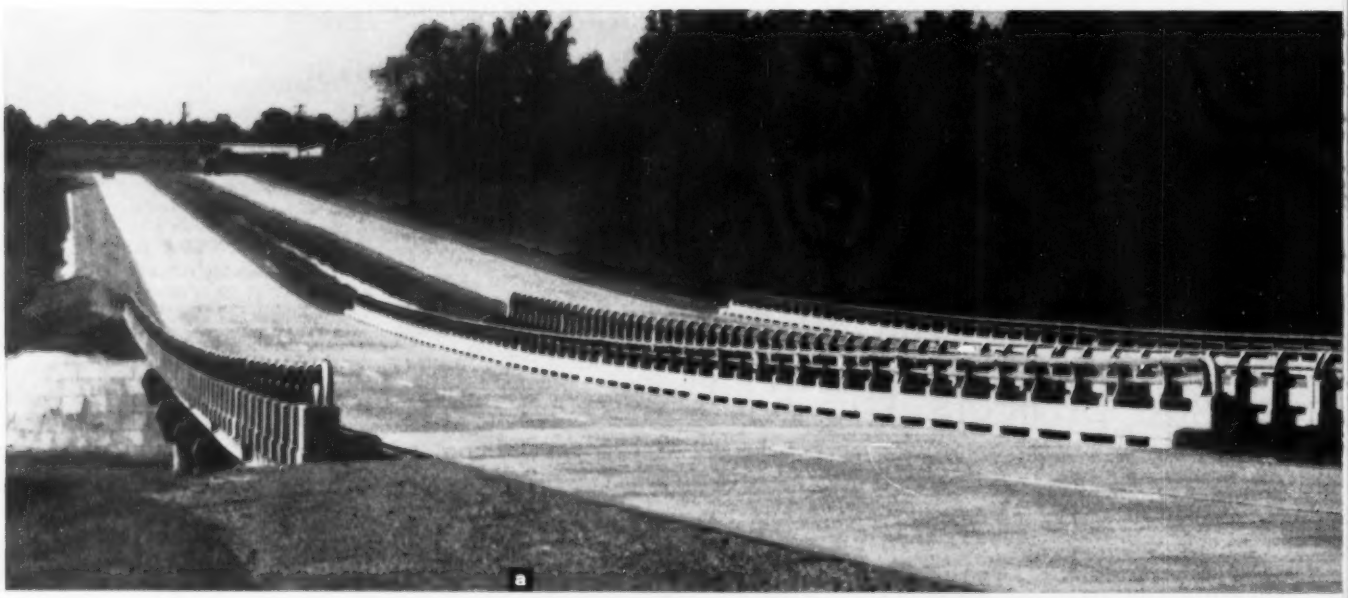
In 1961, more than 1,000,000 tourists will visit some of the Nation's oldest landmarks in Virginia. And they'll travel on some of the Nation's newest highways because Virginia is spending about $76,000,000 in Federal aid funds on its Interstate Highway program. This, in addition to two bond issue projects: the Richmond-Petersburg Turnpike and the Hampton Roads Bridge-Tunnel. For more details, turn page.



Steel Products are the backbone of Virginia's Interstate Highways

Virginia has more than 25,000 miles of hard surfaced roads right now and they're building more. Proposed for construction are 1,053 miles of four lane, controlled access Interstate Highways. This is Virginia's part of the Nation's 41,000 mile Interstate Highway Program. In Virginia, over 80 miles of the Interstate system are in use and 250 of the proposed 2,263 bridges have been built. This work is under the direction of State Highway Commissioner Howard H. Harris and Francis A. Davis, Chief Engineer and Deputy Commissioner.

Millions of feet of steel reinforcing bars criss-cross through the concrete to lock strength into the roadway. Each bridge is designed to take advantage of the strength and economy of steel. USS High Strength and carbon structural steels are effectively combined for minimum bridge weight and maximum clearance. USS "T-1" Constructional Alloy Steel and USS MAN-TEN, TRI-TEN and COR-TEN High Strength Steels are used in bridges where more load capacity, less dead weight and higher corrosion resistance is needed. USS Galvanized Culvert Sheets carry thousands of streams harmlessly under embankments. USS AMERICAN Fencing protects right-of-way and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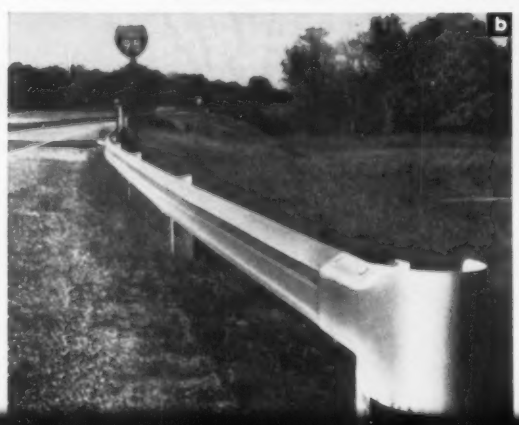
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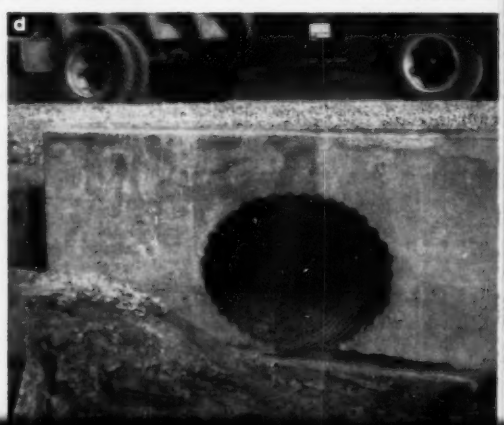
d

USS Highway Beam Guardrail provides safety protection at critical points along the roadway. Steel is also used for driving aids, markers and lighting standards. The *strength* of the Virginia Interstate Highway Program is *steel.*

a The design of each bridge is based on the strength of steel. Bridge railings, reinforcing bars and structural members are all made from steel. **b** Highway guard rail. USS AMERICAN Highway Beam Guardrail has been accepted by most state highway departments because of its extra strength, high visibility and attractive styling. **c** Giant steel auger drills through toughest terrain in all seasons. USS High Strength Steels have the toughness and impact resistance it takes for heavy construction equipment. Steel is so versatile it is used in all types of construction equipment for lightweight and heavy duty applications. **d** Road embankments are saved from costly erosion with steel culverts fabricated from corrugated galvanized USS Culvert Sheets. Culvert sheets assemble easily and first cost is low. They make an ideal economical and strong waterway channel. **e** Steel H-piles are driven to provide solid foundations for bridge piers and abutments. Cranes equipped with USS TIGER BRAND Wire Rope handle more work with less down time. USS TIGER BRAND—America's No. 1 Wire Rope always gives top performance under the most severe conditions. **f** Bridge railings, reinforcing bars and structural members are all made from steel. **g** Steel gives strength to bridges and provides safety protection when it's formed into guardrails. **h** Strong roadways are made with reinforced concrete. USS AMERICAN Welded Wire Fabric has a minimum tensile strength of 75,000 psi and a minimum yield point of 60,000 psi, available in a wide range of styles and sizes. USS DI-LOK Concrete reinforcing bars for pavements, bridge floor slabs, footings and abutments are supplied bent to specification. Highways are built faster and more economically with USS pre-engineered products.

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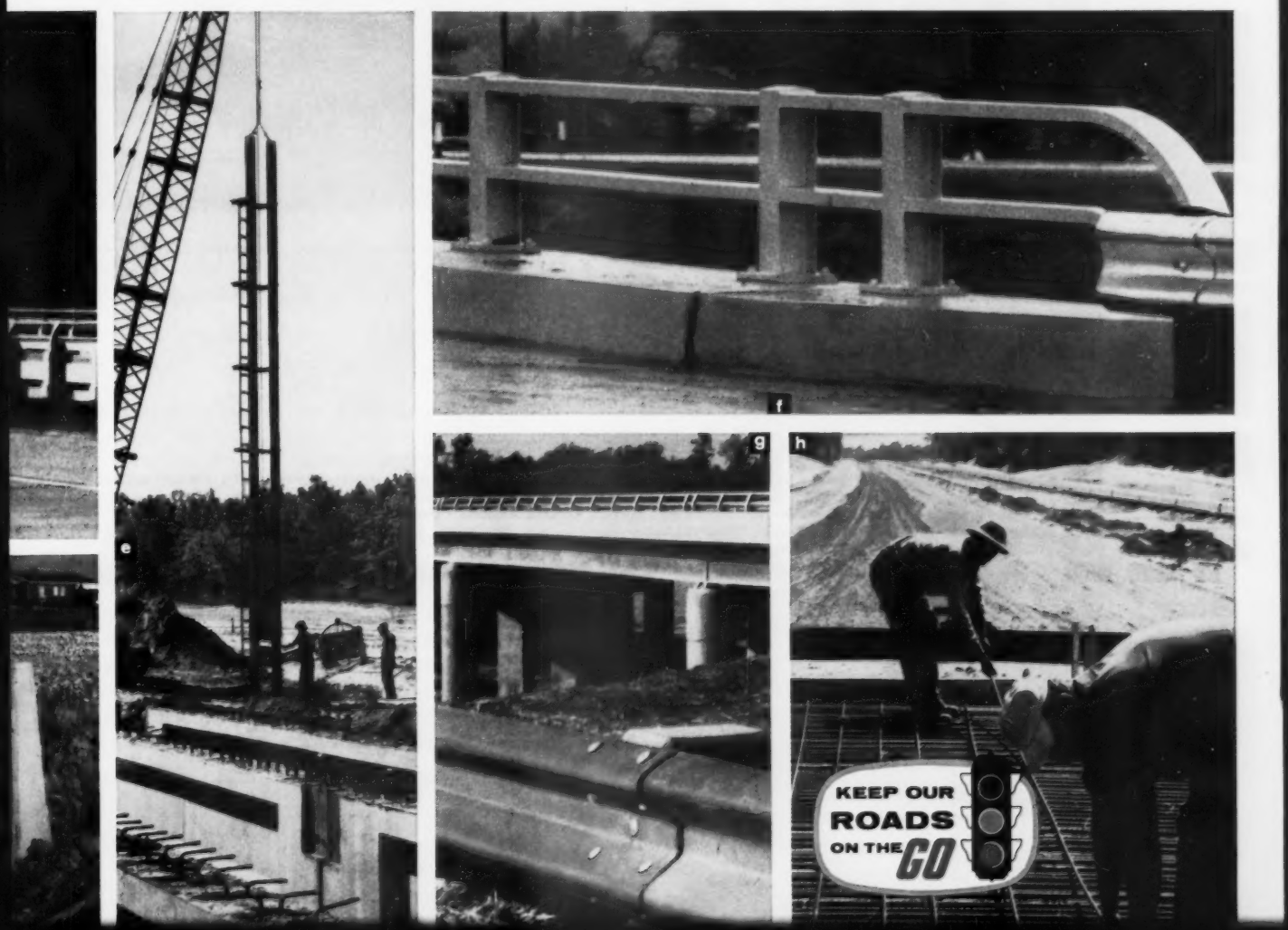
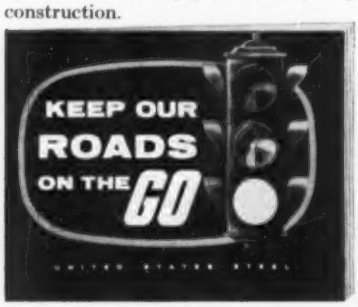
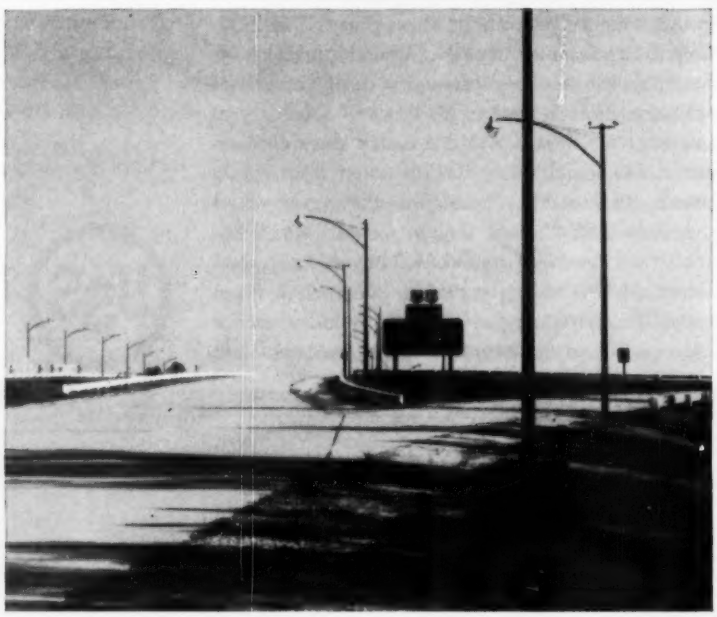
USS United States Steel



Steel bars reinforce pavement for maximum load-carrying capacity and long life. Steel lighting standards and other highway accessories are made from steel. They look attractive with a minimum amount of maintenance and last a long time.

Send for U. S. Steel's *free* 54-page booklet, "Keep Our Roads on the Go." It tells how the complete range of highway products and services available from U. S. Steel cut costs and speed operations in every phase of highway construction.





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The highway market also is served by the following divisions of United States Steel: American Bridge Division, Pittsburgh, Pa. • American Steel & Wire Division, Cleveland, Ohio • Columbia-Geneva Steel Division, San Francisco, Calif. • Consolidated Western Steel Division, Los Angeles, Calif. • National Tube Division, Pittsburgh, Pa. • Tennessee Coal & Iron Division, Fairfield, Alabama • Universal Atlas Cement Division, New York • United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.

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The New Projects

Forth Road Bridge

The Forth Road Bridge, at Edinburgh, Scotland, is beginning to take on a definite shape. Substructures for the huge span, which will be the world's fourth longest, are virtually complete, and work is beginning on the superstructure of the north main tower. Most of the work on the towers is expected to be completed by the end of this year.

The legs of each tower are being made up of 33 welded boxes of high tensile strength steel. The sections are cleaned and painted in special shops, then bolted together on the job. Consulting engineers for the project are Mott, Hay and Anderson in association with Freeman, Fox and Partners, both British firms.

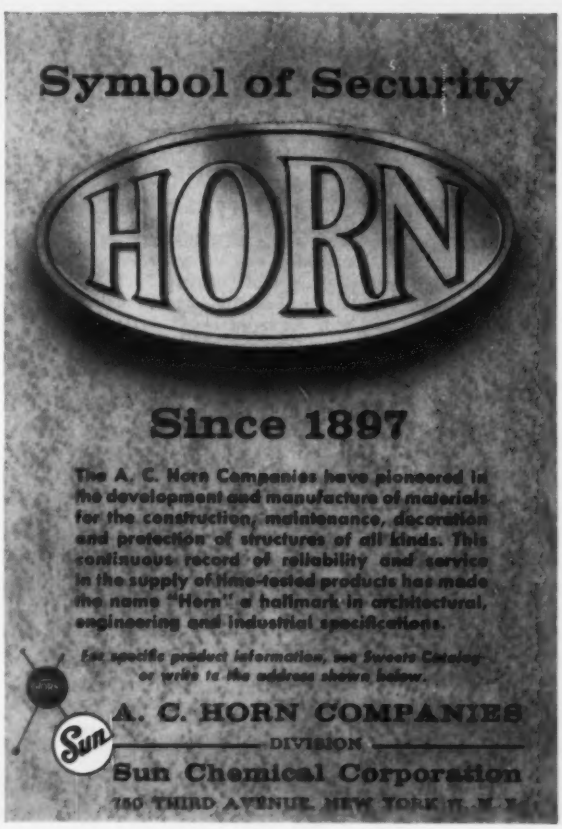
Construction on the Forth Bridge, in Edinburgh, Scotland.

Liverpool Traffic Tie-Up

The city of Liverpool, Great Britain's second largest port, has been severly hampered by the fact that there is only one major crossing for the Mersey River — a tunnel that is continuously over-burdened. The British consulting firm of Mott, Hay and Anderson spent two years studying the problem, and preparing a report of the changes needed to cope with increasing traffic. They were expected to recommend either a new tunnel or a new bridge: they recommended both. First priority went to the bridge, a $75 million, six-lane, high level suspension bridge, with an over-all span of 7750 feet. The supplementary tunnel included in the plans is to be a two lane tunnel, costing about $25 million. The bridge could probably be completed by 1967, and, if built as a complementary project, the tunnel could be finished about the same time.

Moving a City

When the John Day Dam, on the Columbia River, is completed in 1967, water behind the dam will rise to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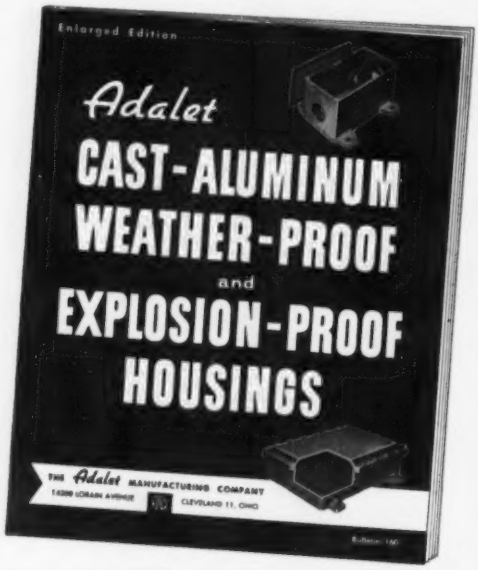

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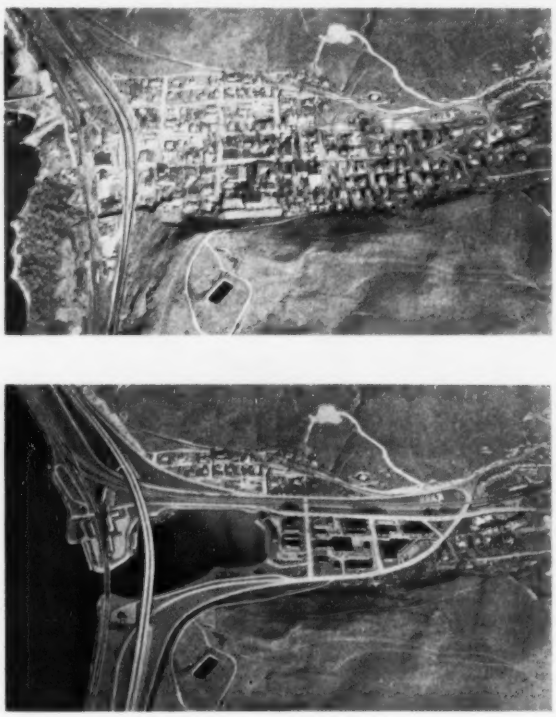
a level of about 269 feet above sea level. One of the cities on the Columbia most noticeably affected by this rise will be Arlington, Oregon, 25 miles upstream. The average elevation of downtown Arlington is about 250 feet above sea level. The U.S. Army Corps of Engineers does not provide engineering service to the communities inundated by the dams it builds, so cities like Arlington have to go to a consulting engineer for a plan to save their property.

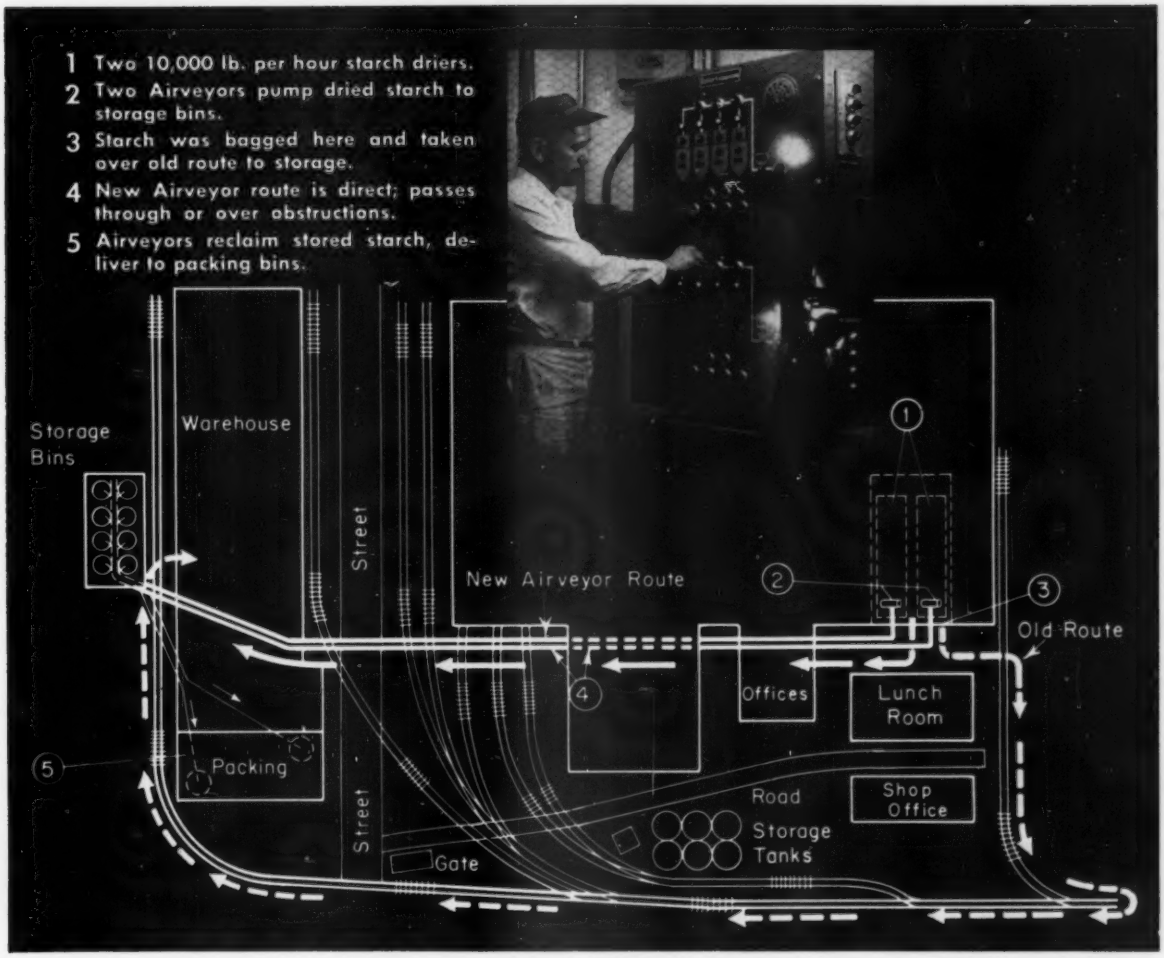
The consulting firm of Cornell, Howland, Hayes and Merryfield, of Corvallis, Oregon, prepared three pre-



Arlington, Oregon, as it is now (top), and as it will be rebuilt after construction of the John Day Dam (bottom).

liminary design studies for relocation of the city. Planning consultant Harlan Nelson then incorporated this information into a basic plan for relocation, under a separate contract with the U.S. Army Corps of Engineers. Clark and Groff, consultants of Salem, Oregon, represented Arlington in the preparation of detailed plans for moving utilities, roads, buildings, and a water storage reservoir.

Final plan for the relocation of Arlington will require removal or demolition of 157 buildings – 70 percent of them wood frame construction, the rest masonry or concrete. Half a million cubic yards of fill will be brought in to raise existing levels in the town site. The lowest section of the present city, which



PLANT MODERNIZATION THROUGH PNEUMATIC CONVEYING

FULLER pneumatic conveying system increases production without plant expansion

To increase production, the Union Starch and Refining Company's Granite City, Ill., plant first needed to expand their materials handling system. But a complete revamping of bagging and warehouse operations was impossible because there was no space available for necessary new buildings.

An Airveyor® System, engineered and built by Fuller, was the answer. Airveyor's extreme flexibility allowed it to be set up through walls, along sides of buildings, over streets, on roofs and up inclines. At Union Starch, the total distance covered is 800 feet, with a number of 45 degree and 90 degree bends in the line.

The Fuller Airveyor system transports the starch in two phases, from the driers to the storage bins and from the bins to receiving hoppers over the bagging machines. Flow is controlled automatically through control panels located in the drier room and at the bagging machines. Other controls are also provided at the panels for automatic operation of components such as feeders, blowers, conveyors and filter-receivers.

Besides being easily installed and automatically controlled, the Fuller system reduces both the amount and the expense of handling. Additional savings are made possible by Airveyor's self-cleaning facility, which greatly reduces maintenance costs.

Why not work with Fuller to design an automated pneumatic materials handling system that will help you cut costs and increase production? Write today for complete details. A-280 1353

See Chemical Engineering Catalog for further details and specifications.

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118 Bridge St., Catasauqua, Pa.
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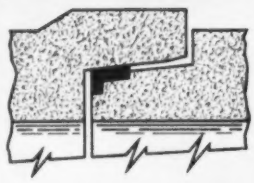
Fast, water-tight coupling for
OFFSET CONCRETE PIPE *with*

TYLOX "C-P" GASKETS

TYLOX "C-P" Gasket is designed for concrete sewer pipe having either single or double tongue offsets. Gasket consists of heavy base, multiple sealing fins, and a positioning flange which overhangs the edge of the tongue offset. "Locking" effect of the flange holds gasket in true position as pipe is coupled.



Type "C-P" TYLOX under full compression on offset concrete pipe.

"C-P" Gaskets are the true compression type, available in either rubber or neoprene, and withstand head pressures up to 50-feet. They may be installed at the job site, or the pipe manufacturer's plant. Specially compounded to resist sewerage and industrial waste acids, they never deteriorate. Write for brochure.

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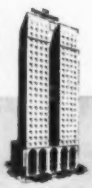

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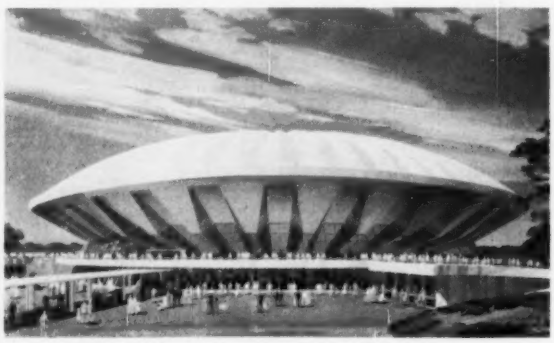
Route 30, Lincoln Highway,
Shortest Route to Pittsburgh

will be completely inundated, will become a marina for small boats. In addition to the city, a few other items will have to be moved, including US 30 and a section of the Union Pacific RR.

Unusual Stadium Uses Dome on Cone

The University of Illinois is building one of the most spectacular indoor stadiums in the country. Scheduled for completion next year, the new stadium will be in the shape of an inverted truncated cone, with a column-free dome covering it.

The dome will be supported by a 400-ft diameter post-tensioned concrete ring beam, integral with the



Flying saucer appearance of new Illinois U field house.

top of the cone section of the stadium. The beam, with a cross-section area of about 20 sq ft, will be wrapped with some 600 miles of prestressing wire. The wire is laid by a self-propelled machine, guyed at the center of the stadium, which will travel around the ring 2500 times, wrapping the wire. As it is wrapped, the wire is drawn from .236-in. to .208-in. diameter.

Total cost of the new stadium will be close to $8 million. Structural engineer for the project was Ammann & Whitney, of New York.

Beverly Hills' First Parking Ramp

One of the few multistory prestressed rigid frame concrete structures in the world is the new six-story parking ramp designed for the city of Beverly Hills, California, by Welton Becket and Associates of Los Angeles. The structure has a continuous ramp to permit self parking of about 400 cars.

An unusual construction method utilized precast, one piece beams, 64-ft long, which were prefabricated and trucked to the spot. Structural engineer for the project was T. Y. Lin and Associates.

Relieving Crowded Schools

The City of Detroit, suffering acutely from an overcrowded school system, is considering a plan for small auxiliary classroom buildings. The new units,

ENGINEERED TO "TAKE CARE OF ITSELF"...

New Chapman 960B Rugged-Duty Forged Steel Gate Valve

In valves, "forgetability" is a true measure of worth. "Forgetability" is defined in terms of those qualities which allow a valve, once installed, to be almost forgotten. It results from perfection of performance, and year-after-year dependability; combined with less than moderate maintenance requirements. These characteristics are the outgrowth of knowledgeable design and excellence of materials . . . both are tradition with Chapman Valves.

Product of an all-inclusive development program by Chapman, the *originators* of forged steel gate valves, the 960B represents the integrity in design, thoughtful selection of materials, and pride in workmanship which have made their name synonymous with quality valves since 1875.

Wheel . . . cast ductile iron. **Stem** . . . heat-treated stainless steel; backseats in bonnet. **Yoke Sleeve** . . . corrosion resistant Chapman alloy CV510. **Follower and Gland** . . . socket and ball type: bind-proof follower; stainless steel gland. **Eyebolts** . . . stainless steel; swing-down design. **Yoke** . . . "bowlegged" design for exceptional hand room. **Stuffing Box** . . . bigger, with special, heavy-duty packing **Bonnet and Body** . . . forged carbon steel. **Male-Female Joint** . . . for precise alignment; makes gasket blowout impossible. **Gasket** . . . asbestos filled, spiral-wound, flexible stainless steel ribbon. **Disc-Stem Connection** . . . sliding joint prevents load transfer. **Disc** . . . hardened stainless steel; guided travel. **Seat Rings** . . . shoulder type, Stellite-faced stainless steel. **Universal Trim** . . . all standard services; temperatures to 1000°F; pressures to 2000 psi.

PRESSURES TO 2000 PSI ☐ TEMPERATURES TO 1000 F ☐ SIZES ¼ TO 2 IN. ☐ UNIVERSAL TRIM FOR ALL SERVICES

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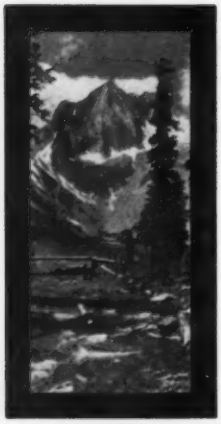

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Avenue **MOTEL**

Michigan Ave. at 12th St., Chicago, Ill.

designed by Lynn Smith Associates, of Birmingham, are self-contained 5-room concrete block structures, costing about $65,000 apiece. If approved, they will be used to replace the city's current system of movable auxiliary buildings. The present "movables" cost more than the concrete block structures, and they have yet to be proven portable.

San Fernando Department Store

Late next year, a new shopping center will open in San Fernando, California, with about 20 stores specializing in fashions and home furnishings. Largest store in the group will be Bullocks, one of a chain of West Coast clothing and fashion stores. The architectural style

Spanish-California design of new Bullocks, San Fernando.

throughout the center is based on the Spanish California tradition, and the 5-story Bullock store is planned to reflect the Spanish colonial pattern particularly. The store was designed by the Los Angeles firm of Welton Becket and Associates, who also acted as architectural supervisor for the entire center.

Movieland Converted to Home Sites

A group of developers has purchased 260 acres of former film location property for conversion into a housing area. The development, immediately west of Beverly Hills, California, will be known as Century City. When it is completed, it will represent more than a quarter billion dollars worth of buildings and land — the largest privately financed urban development in the U.S. The engineer for the project is Daniel, Mann, Johnson, & Mendenhall, of Los Angeles.

World's Largest Drill

An enormous drill, weighing more than 120 tons and towering nearly eight stories high, is being used by the Case Foundation Company, of Roselle, Illinois, to install concrete caisson foundations for the $36 million Marina City Center in Chicago. Consulting engineer for the project is Bertrand Goldberg and Associates, of Chicago. The Marina City project, a

Versatile **steel pipe** lines the Golden Triangle's "$15 Million Jewel Box," The Pittsburgh Hilton

15° to 90° bends are simple to form, joints quickly cut and made on the job when rigid steel conduit is used for light, power and communication lines. Its strength, durability and rigidity enables it to withstand abnormal abuse.

Insist on MADE IN USA Steel Pipe

Thousands of feet of *steel pipe* are efficiently and silently at work in the glamorous new Pittsburgh Hilton. *Steel pipe* water, waste and vent lines will provide decades of maintenance free service. The hotel's electrical network will function efficiently and well because it is enclosed in time-tested rigid steel conduit.

There are many other good reasons for the universal uses for *steel pipe* and rigid steel conduit in monumental buildings. Among them are:

1. Steel pipe and rigid steel conduit are available everywhere in required sizes, finishes, quantities. They meet all codes.
2. Load bearing *steel pipe* permits quick vertical and horizontal aligning, supports heavy loads, takes more abuse, both before and after installation.
3. Rigid steel conduit has proved strength, is corrosion resistant and offers a completely safe, grounded system. Re-wiring for future loads and increased use of power is simplified.

No wonder *steel pipe* is the world's most widely used tubular product for radiant heating, cooling, refrigeration, ice making and snow melting; power, gas and air transmission.

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- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
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- Threads smoothly, cleanly
- Sound joints, welded or coupled
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- Available everywhere from stock

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block-square undertaking which will take two years to complete, will feature twin 60-story apartment towers, the largest in the world.

The special new drill, designed and built by Case, cost one-third of a million dollars. It is capable of penetrating virtually any type of soil to a depth of 200 feet, and thus should be able to reach bedrock in any area of the world.

McCormick Place

McCormick Place, Chicago's mammoth exhibition hall, has been opened for use. The 10-acre building, known more formally as the Chicago Metropolitan Exposition and Authority Building, takes up about three city blocks on Chicago's lakefront. In addition to the 320 thousand square feet of exhibition floor space, there are two theaters, a restaurant, a cafeteria, an art gallery, and dozens of meeting rooms. Air treatment and handling equipment for all this proved to be a major engineering headache. In all, the consulting engineers, John Dolio & Associates, of Chicago, planned 60 air conditioning systems to supply the building.

The entire heating and cooling apparatus is centered around a large lower-level area, comprising a boiler room, supplying low pressure steam for heating; and a refrigeration room, providing 42F water for cooling. The boiler room contains four Cleaver-Brooks 600 hp boilers, and the refrigeration room contains three centrifugal plants with a refrigeration capacity of 4000 tons. The major control center, located above the boiler room, is a centralized panel for controlling the entire building. There are temperature sensing elements in 140 different locations; the control center monitors each one and mixes warm and cold air to provide the correct temperature in each area. The hall is designed to accommodate crowds as large as 30,000. ▲▲

The McCormick Exposition Hall, on Chicago's lake front.

NOW...one man can splice Rubber Waterstop in just SIX minutes!

To splice Gates new Kwik-Seal Rubber Waterstop in the field, all you need is a small splicing kit and a simple clamping device. This eliminates the need for a field vulcanizer, molded parts, a power supply or heat.

One man makes this strong, permanent splice in just 6 minutes—5 times faster than with former methods!

The Gates Kwik-Seal splice is a chemical bond. The strength of the bond often exceeds the strength even of the rubber—far stronger than government requirements. The waterstop can be handled and placed into concrete forms immediately after splicing.

As a result, this new Gates splicing method cuts labor costs and speeds the job.

Write for CATALOG and free splicing demonstration.

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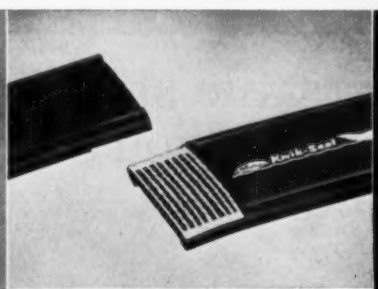
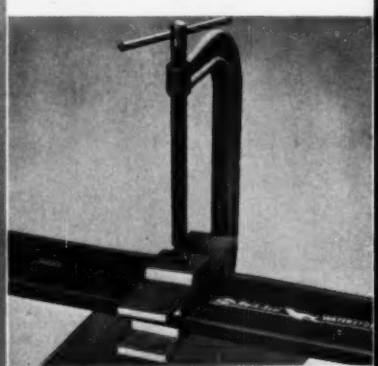
Building the Future on 50 Years of Progress

Gates

Gates Kwik-Seal Waterstop



1 Apply Kwik-Kem bonding chemical to prepared surface.



2 Clamp Waterstop firmly for 5 to 6 minutes . . . *and it's spliced.*

SEE OUR CATALOG IN SWEET'S

measure Roebling's "Bridge-Ability"

Shown here is the new Kishwaukee River Bridge at Seth B. Atwood Park, New Milford, Illinois. It was designed, furnished and erected by the Wisconsin Bridge & Iron Company, Milwaukee, Wisconsin. Its main cables are Roebling 1⅝" prestretched, galvanized bridge strand.

This structure is an excellent example of the scope of Roebling's Bridge Division activities, whether it be large or small—design, erection or, as in this instance, supplying the cables.

Doubtless, you don't have a "Golden Gate" to bridge at the moment. You may, though, have a pedestrian handling problem in your plant, a materials-handling problem *anywhere*. It is important to remember that Roebling's familiarity and experience with suspension systems of *any* description puts us in the unique position of being fully able to help you solve problems along these lines. We welcome inquiries touching on any phase of suspension by wire rope or strand. Just ask Roebling's Bridge Division, Trenton 2, New Jersey.

by the mile
(Golden Gate Bridge)

by the foot
(Kishwaukee Bridge)

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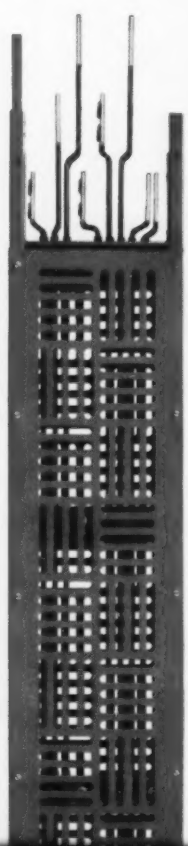
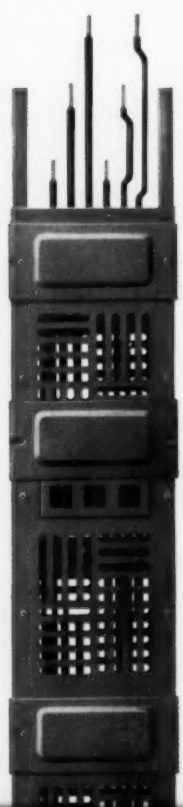
8 types of Westinghouse bus duct— WHY?

PLUG-IN . . . For industrial or commercial applications . . . 225- through 1000-ampere ratings. Plug-in outlets every 12 in. along run. Good for meeting changing requirements in industrial plants.

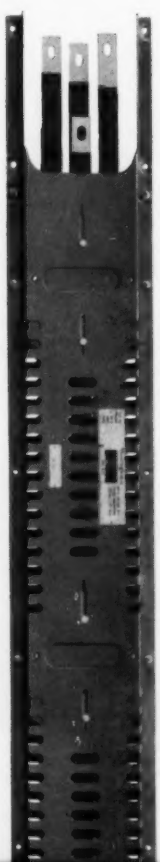
LOW IMPEDANCE . . . Maximum efficiency for long feeder runs . . . 600- through 5000-ampere ratings. Indoor or outdoor applications. A wide variety of special fittings makes this bus duct most flexible to meet special requirements.



PLUG-IN LOW IMPEDANCE . . . Combines the high efficiency of low impedance design plus the convenience of plug-in receptacles. Ratings 600 through 4000 amperes. Accepts standard 3-pole plug-in devices, interchangeable with conventional plug-in duct.



LIFE-LINE . . . A plug-in bus duct with the ultimate in safety features. The plug-in unit can be completely installed and wired before contact is actually made with the bus bars. Ratings 225 through 4000 amps.



Simply because no **one** type will properly meet all duct applications. When the factors of voltage drop, frequency, over-all cost, capacity and plug-in features are weighed, it takes many types to do the job properly. That's why Westinghouse makes 8 specialized types of duct.

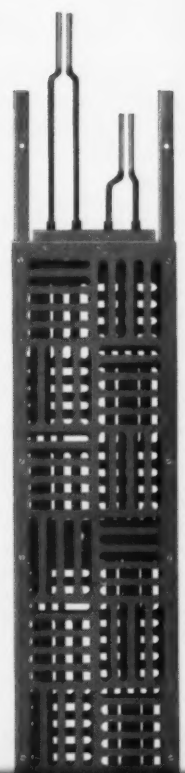
To the consulting engineer, this means the opportunity for optimum design; to the contractor it means fast installation; to the plant engineer it means power savings and low maintenance.

Want complete information on how these 8 types of Westinghouse bus duct can provide a long and useful life for a new building or a new lease on life for an old one? Contact your Westinghouse representative or write: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. J-30322

Westinghouse

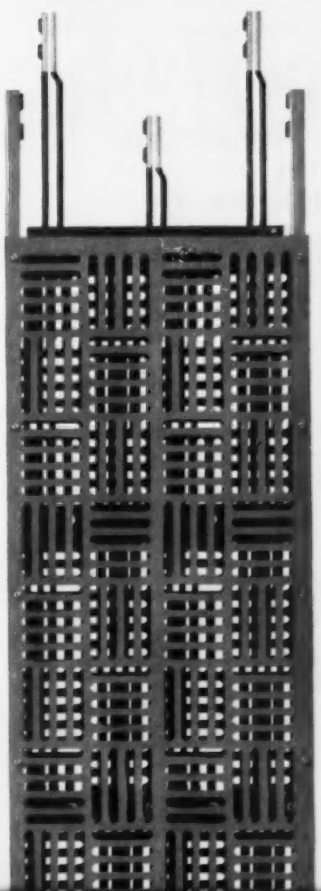
HIGH-FREQUENCY... Most efficient of all power distribution systems for high-frequency application—400 cycles and above. Voltage drop of less than 1 volt per 100 ft at full load. Has plug-in convenience for easy power take-off. Typical applications include aircraft or electronic manufacturing, induction heating and many others.

D-C (Electric Utility) . . . Specially for the distribution of direct current in power plants or factories. Available in ratings of 225 to 12,000 amperes. Uses include excitation service for turbine generators, telephone exchanges, battery charging and plating facilities.



100-AMP . . . A new low-capacity, low-cost busway system designed for low current applications with all of the inherent advantages of bus duct. Has plug-in convenience, complete salvability, low installed cost. Fast installation possible because of snap-together joint and completely captivated hardware.

CURRENT LIMITING . . . A bus duct for use feeding from networks, designed specifically to limit the fault current to a value that conventional circuit protective devices can safely interrupt. Ratings 1000 to 4000 amps. Ideal for entrance runs. It also can be used in conjunction with other types of duct.



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or Special Tools to install

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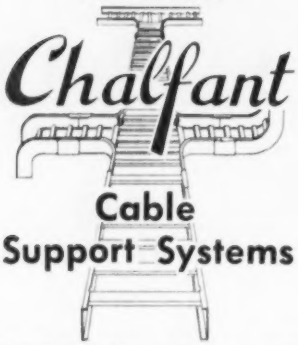

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Chalfant Splice Plates and Trays are securely fastened by the exclusive Chalfant Crimping Method . . . to reduce installation time way below conventional methods. Lower costs are also achieved with Chalfant systems because each splice plate and tray is made from high quality, longer lasting, economical Aluminized steel.

You'll save 15% on material and 40% on installation when you use Chalfant Systems to produce a better job.

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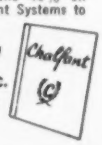

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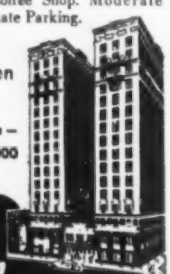

The New Hotel

Wolverine

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Consulting Engineers' Calendar

April 5-7. American Institute of Electrical Engineers; Southeast Meeting, New Orleans, Louisiana.

April 9-13. American Society of Mechanical Engineers; Oil & Gas Power Conference & Exhibit, Jung Hotel, New Orleans, Louisiana.

April 10-14. American Society of Civil Engineers; Convention, Hotel Westward Ho, Phoenix, Arizona.

April 18-20. National Institute for Disaster Mobilization; Industrial Mutual Aid & Disaster Control Seminar, Shamrock-Hilton Hotel, Houston, Tex.

May 1-3. Electric Association of Chicago; Lighting Exposition, McCormick Place Exposition Center, Chicago, Illinois.

May 4-6. 1961 Annual Meeting of Consulting Engineers Council, Chicago. Business meetings will be conducted at the Executive House, on the north side of the Loop. New Council officers will be installed during the meeting, and the annual banquet will be held at the Illinois Athletic Club Friday evening, May 5.

A full business agenda is planned, and some of the more pressing problems of the consulting engineer in private practice will be discussed. Members of member associations of CEC are specifically invited, as all business meetings are open to the entire membership.

Members of the Host Committee, from the Chicago Association of Consulting Engineers, are C. E. Evanson, chairman; E. J. Wolff; R. Wolfson; J. Klipp; L. H. Nettnin; and E. L. Daugherty. The Executive Committee of the Board of directors of CEC will meet for two days immediately preceding the regular business meeting.

May 7-10. American Institute of Chemical Engineers; Meeting, Sheraton-Cleveland, Cleveland, Ohio.

May 16-18. Building Research Institute; Spring Conferences, Shoreham Hotel, Washington, D. C.

May 19-20. New York State Association of Consulting Engineers, Inc., 4th Annual Convention, Treadway Inn, Niagara Falls, New York.

May 22-26. Society of Photographic Scientists & Engineers; National Conference, Hotel Commodore, New York, New York.

June 4-9. American Water Works Association; Annual Conference, Detroit, Michigan.

June 6-8. West Virginia University; Sixth Annual Appalachian Underground Corrosion Short Course, Campus, Morgantown, West Virginia.

June 11-15. American Society of Mechanical Engineers; Semiannual Meeting, Statler-Hilton Hotel, Los Angeles, California.

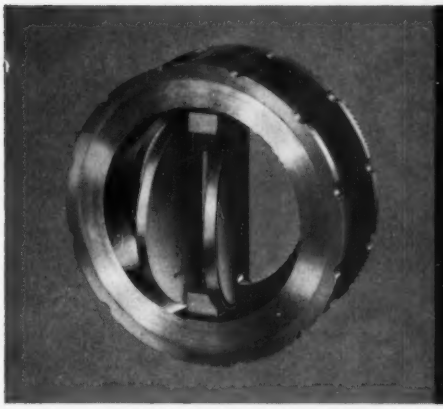
June 12. Instrument Society of America; Air Pollution Instrumentation Symposium, Hotel Commodore, New York, New York.

June 18-23. American Institute of Electrical Engineers; Summer General Meeting, Ithaca, New York.

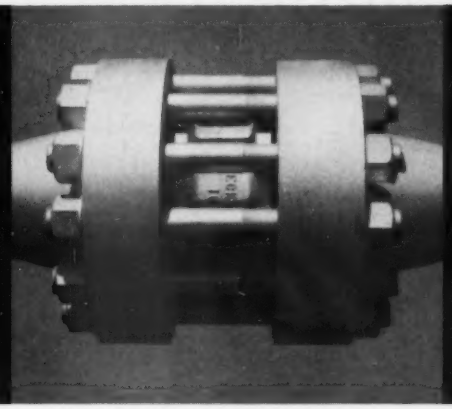
June 25-30. Pennsylvania State University; Engineering Seminar — "R and D Management Development," University Park, Pennsylvania.

July 5-8. National Society of Professional Engineers; Annual Meeting, Olympus Hotel, Seattle, Wash.

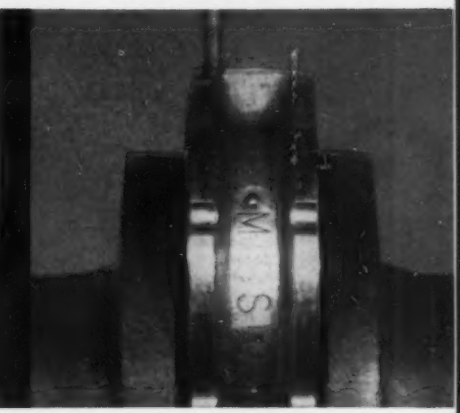
COSTS LESS—WEIGHS LESS—EASY TO INSTALL



Because of its sound, imaginative design, the Duo-Chek check valve is smaller, uses less material, and costs less to buy. It costs less to maintain and lasts longer, too.

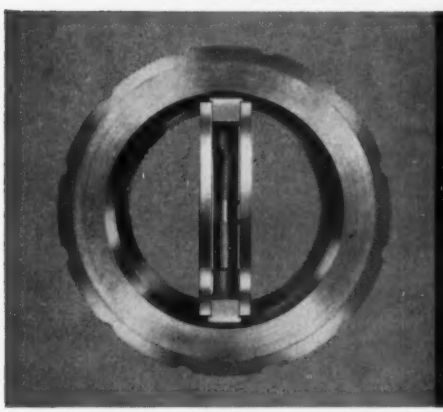


A Duo-Chek check valve weighs on the average less than ten per cent, with some models weighing only two per cent, as much as conventional check valves for the same service. No foundations are needed.

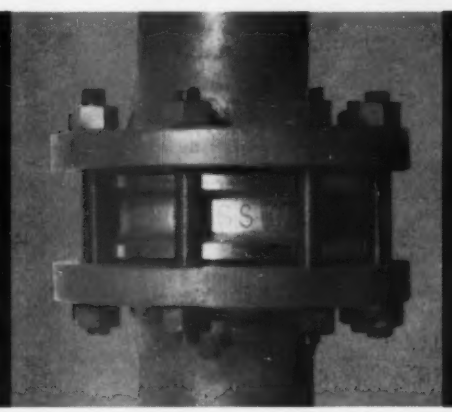


The Duo-Chek fits between the flanges, is smaller and weighs less. For example, a 6-inch steel valve, series 300, weighs 29 lbs., requires no special installation equipment.

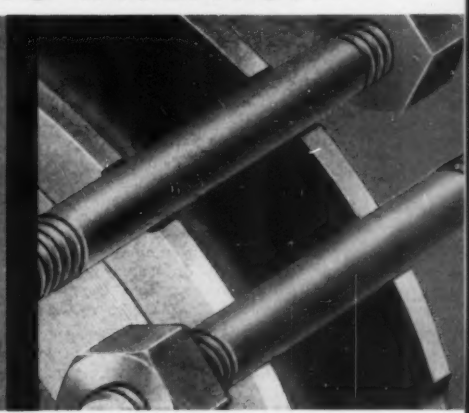
NO SLAM—ANY POSITION—CUTS INVENTORY



A stainless steel coil spring effects positive sealing action. The quick action of the spring closes the valve before reverse flow can occur. Result: No slam, no water hammer.



The Duo-Chek simplifies piping arrangements. The spring loaded plates operate in any position. Most popular sizes can be installed even in vertical lines with downward flow.



The unique versatility of the Duo-Chek greatly reduces inventory. In sizes 2 through 12 inch, one valve fits both series 150 and 300 flanges; 2- and 3-inch sizes fit series 600, too.

MISSION **DUO-CHEK** CHECK VALVE

The Mission Duo-Chek® check valve performs all regular check valve duties, yet is smaller, lighter, and easier to install. Duo-Chek check valves are available in a complete range of sizes from 2 to 48 inches, ASA Series 125 through 2500. They come in various end connections, such as raised face, ring joint, weld neck, etc. They are made in carbon steel, stainless steel, aluminum, and bronze. Special alloys are available. Because of the small size of the Duo-Chek, special alloy valves cost much less than conventional valves in the same alloy.

Sealing material is bonded in a groove in the plate. The sealing material makes an O-ring seal, which pressure deforms until metal-to-metal contact is made by the plate and body seat. Sealing material may be Buna-N, Teflon, Viton, or metal, depending on the service.

The simplicity of design of the Duo-Chek pays off in every installation with longer life and less maintenance. Only six parts are contained within the body of the Duo-Chek, held without the use of internal fasteners or joints of any kind. All parts are interchangeable.

The Duo-Chek is much lighter in weight than conventional check valves, yet is stronger. By dividing the opening, the unsupported plate area is reduced so that each plate requires only one-eighth of the weight of a conventional clapper of the same strength. The short stocky body is inherently stronger and more rigid than a short length of heavy wall pipe.

Whatever your check valve application, the Mission Duo-Chek can cut initial purchase and installation costs, cut maintenance costs from then on. Contact Mission now for a representative.

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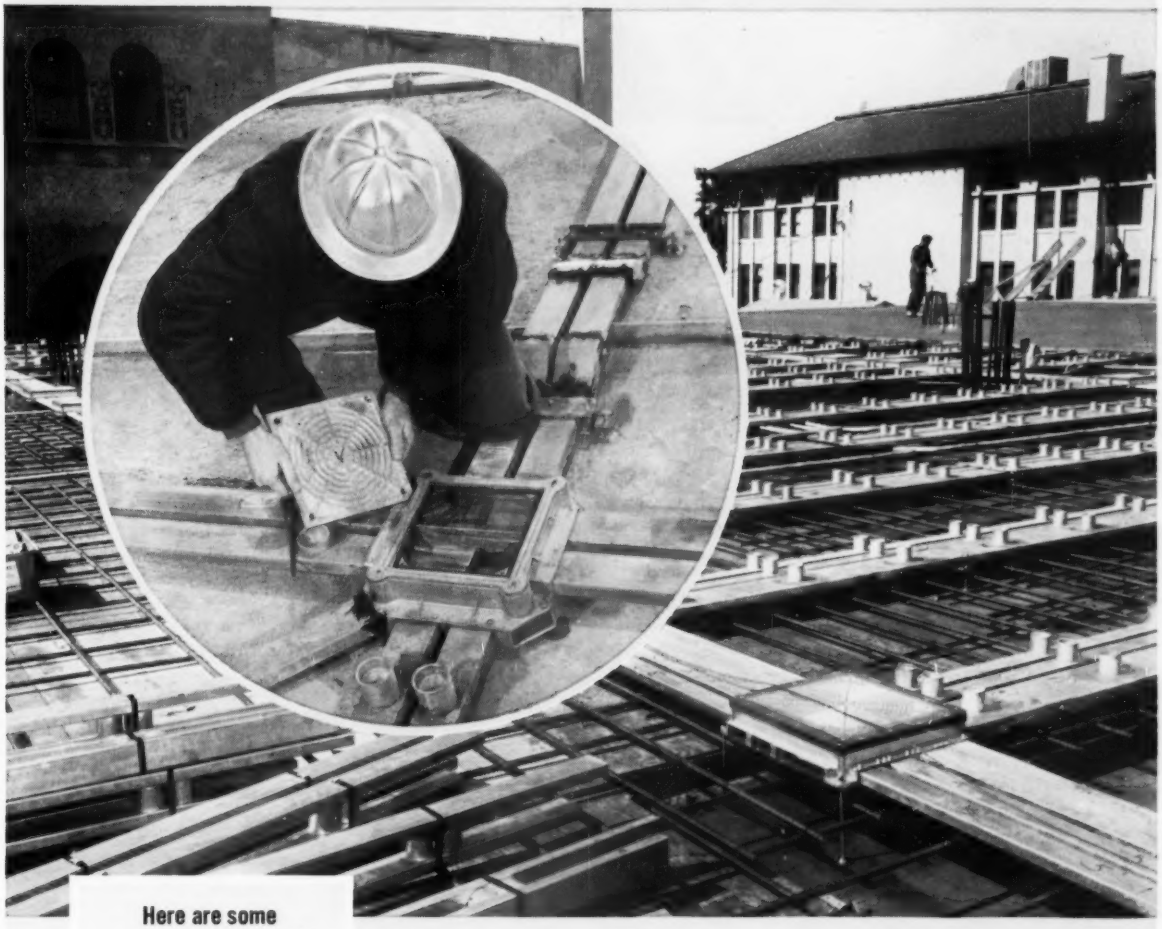

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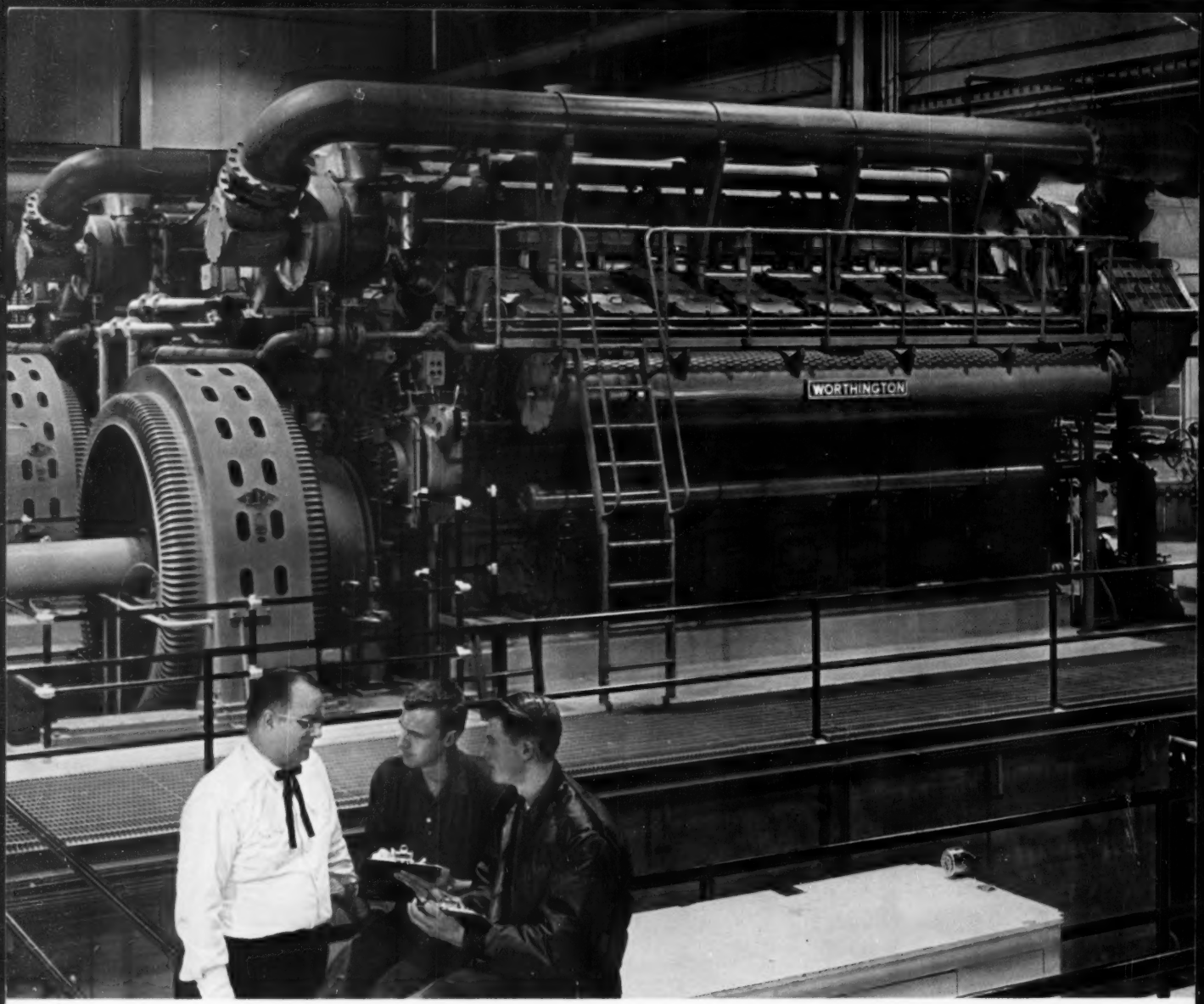

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